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Pipe-Threading Machine.

The engraving presented herewith illustrates a new form of pipe-cutting and threading machine, intended to be driven either by one man or two men working cranks on opposite sides of the machine; or, by changing the cranks from one shaft to another, different ratios of speed of crank to dies may be obtained, thus giving ample power for threading pipe of large diameters, and at the same time enabling smaller sizes to be threaded at a faster rate. It may also be driven by power, when desired.

This machine is so arranged that a pipe may be threaded and afterwards cut off at any desired point without removing any part of the machine or making any change whatever.

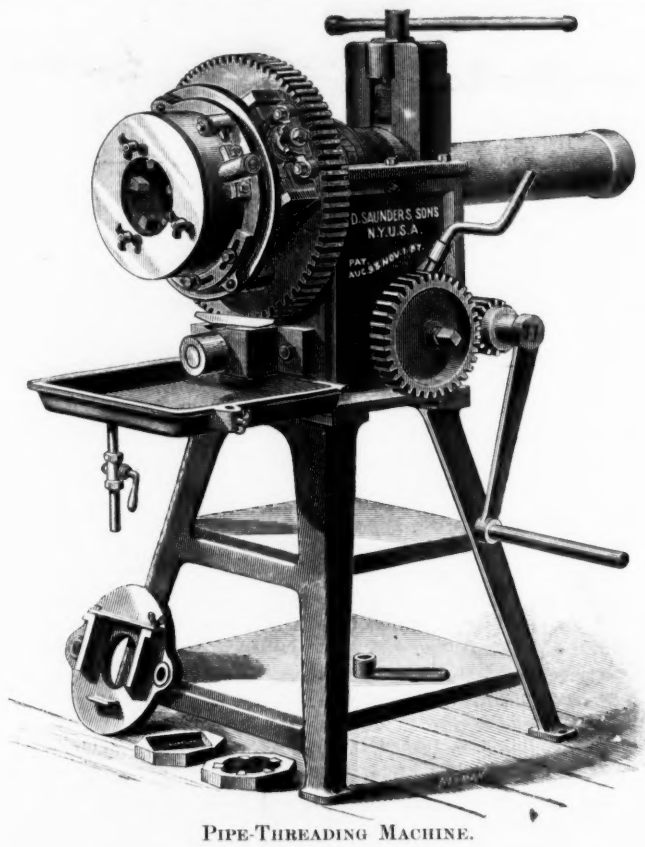
The machine has a capacity up to and including 4″ pipe, and is adapted to either solid or adjustable expanding dies. The pipe to be threaded is held in a vise at the back of the machine, which centers it, and there are V-shaped jaws of steel (*J J*, in the detail cuts, page 2,) which are closed on the pipe by right and left-hand screws, and serve to center it properly in the dies.

There is a threaded sleeve, by means of which large pipes are forced forward into the dies at the proper rate, and this may be used or not, as desired.

The cutting-off fixture is fixed to the face of the large driving gear between it and the die in such a manner that either may be used without interfering with the other.

The detail cuts before referred to show the construction of the cutting-off mechanism—*W* being the large gear wheel, on the face of which are slides, cast solid with the wheel and planed out to receive the sliding pieces which hold the V jaws. Upon one of these pieces is provided the slide for the cut-off tool *T*, this tool being fed in by a screw worked automatically by the ratchet and pawl mechanism shown in Figs. 2 and 3. The lever *t* strikes two pins during a revolution of the wheel, by which it is moved from one to the other of the two positions shown in Fig. 3, feeding a notch and returning by the action of a spiral spring, which goes on over the pin *c*, and is adjustable for tension by the nut shown. The die-holder goes on over this, and is fastened by bolts in the two holes shown in the gear, Fig. 2. The screw *s* holds the cut-off tool in position. The machine is made without legs, to set on the bench when desired.

The makers are D. Saunders' Sons, Yonkers, N. Y.



PIPE-THREADING MACHINE.

The United Typothetæ, an organization of employing printers, at a recent convention held in St. Louis passed a resolution favoring the passage of State and national laws making it obligatory upon apprentices to serve a period of five years. In other words, they ask Congress to help them in managing their apprentice boys. We respectfully suggest that the members of the Typothetæ do as is done by employers in other lines of business, make it worth while for apprentices to serve the time necessary to thoroughly learn the business, and refrain from doing the grand baby act.

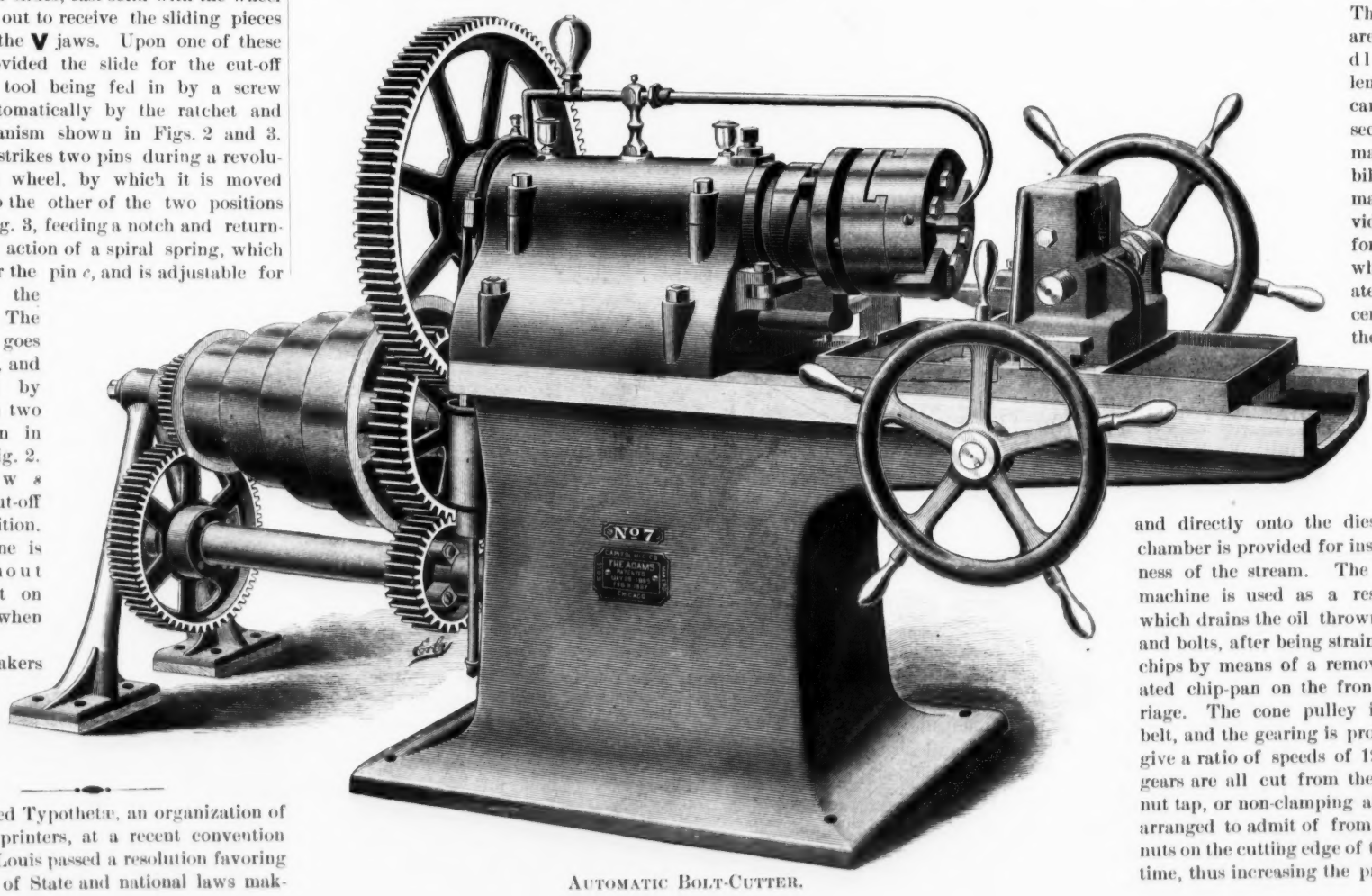
The Adams Automatic Bolt-Cutter.

The illustration on this page is of a newly-designed bolt cutter, the details of the die mechanism used having been illustrated in our issue of April 25.

The automatic device for opening and closing the head is positive in its action, so that the bolt cannot fail to be released at the end of the cut. The dies are fixed solidly in two sliding parts, which have large sliding surfaces, and are so arranged that when the head is closed the die is practically solid. Cams are provided for moving the sliding parts, which are actuated positively by the motion of the machine, both in closing and opening the dies.. The head is made entirely of steel, all wearing parts being hardened. The dies are readily adjusted, and no chips can possibly get in around them to interfere with their action. They are simple in form, and readily sharpened or hobbed when required, this hobbing being done in a dummy head in the lathe when preferred, so that the machine need not be stopped for the purpose.

The bolt-heads shown on the face of the die-head secure the dies in place, and these heads can be let into the head when desired, so that bolts may be cut close up to the heads. A circle is drawn on the face of the head, and corresponding arcs on the dies, by which they may be readily set when hobbed or re-hobbed; and dies are furnished by the makers ready for use by those who do not care to make their own.

As will be seen, the carriage has an unusually long bearing on the bed, and is gibbed and provided with means of adjustment for wear. The vise jaws are in the middle of the length of this carriage, thus securing the maximum stability. The machine is provided with a force pump, which is operated by an eccentric from the main spindle, and throws a steady stream of the lubricant into the head, and directly onto the dies. An air-chamber is provided for insuring steadiness of the stream. The base of the machine is used as a reservoir, into which drains the oil thrown on the dies and bolts, after being strained from the chips by means of a removable perforated chip-pan on the front of the carriage. The cone pulley is for a 3½″ belt, and the gearing is proportioned to give a ratio of speeds of 12 to 1. The gears are all cut from the solid. The nut tap, or non-clamping attachment, is arranged to admit of from two to four nuts on the cutting edge of the tap at one time, thus increasing the product three-



AUTOMATIC BOLT-CUTTER.

fold. This feature is desirable only where the machine is used largely for nut as well as for bolt threading. Special pains have been taken to have every part of these machines of best possible proportions, and they are made in different sizes to cut bolts from ¼″ to 5″ diameter; all those intended for bolts larger than 3″ having a geared vise. The makers are the Capitol Mfg. Co., Chicago, Ill.

Steam Plant for Isolated Electric Lighting Purposes.

By Prof. John E. Sweet.

(A paper read before the Western New York Association of Architects.)

It is evident that the growth of the electric light business was never so healthy as at the present time, and, further, that its introduction in new business buildings is the rule rather than the exception, and that money can be saved by making proper provisions for the plant before the plans of the buildings are adopted rather than after they are completed.

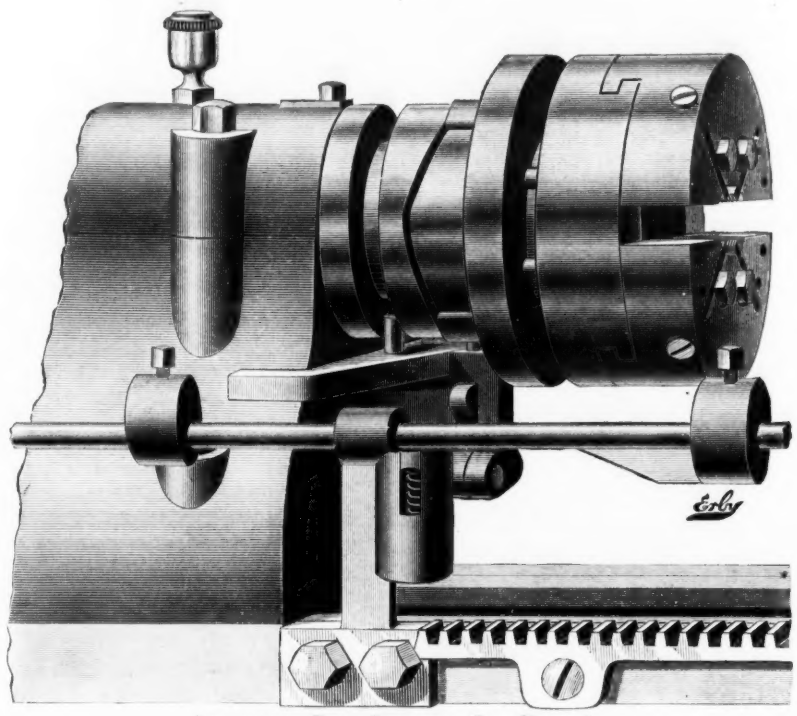
The two most prominent difficulties we have to contend with are height in the basement for the boilers, and length in the room appropriated to the engine and the dynamos. So far as it is left for the architect to decide, where it is not possible to get height for boilers, the best way out of the difficulty is to use high-pressure small boilers, and more of them.

The same tactics apply in the case of boilers as have overcome the difficulties in engines. The small high-speed engine renders a small space available, and so with small high-pressure boilers. The objection raised against them is the danger from explosion; but this is imaginary, for, other things being equal, the 36-inch boiler is just as safe at 120 pounds pressure as the 72-inch at 60 pounds; but other things are not equal; more care and better material is almost invariably used in the case of the high than with that of the low-pressure generator. Another point, the high-pressure boiler is the more economical for the reason that it takes nearly a thousand units of heat to get steam at atmospheric pressure, after which it only takes about twice as many units to get the 120 pounds that it does the 60 pounds, out of which we can get twice the work.

The argument is advanced that should a boiler explode, the damage would be much more serious with high-pressure than with low, but this I imagine is not true to any extent. The large boiler at 60 pounds and the small one at 120 pounds would either be bad enough; but it is not necessary to take that into consideration, for there never was an explosion that was not preventable, and with modern safety appliances and a careful engineer, explosions may be classed as a remote contingency.

In this latitude, where buildings have to be heated by using the exhaust steam for the purpose, the cost of running electric lights is not very great; or, if preferred, one may say the cost of heating is not very great. Some get the notion that because in cases where the system is not properly arranged and a pound or two of back pressure is put upon the engine, that the use of the exhaust costs as much as it comes to. But when one considers that when steam is exhausted at atmospheric pressure, it contains 960 units of heat, and at two or three pounds pressure not over 970, the two or three pounds of back pressure do not amount to much. When there remains this vast amount of heat in exhaust steam, it is the height of folly to throw it away, for with a properly arranged system even the two or three pounds of back pressure may be avoided.

In placing a plant in an old building, lack of chimney capacity is often met with, and this in planning new should be considered. A round chimney flue is better than a square one, but not easy to deal with running through the upper stories; a hexagon or octagon is also better than a square, and it would seem that the excessively large chimney breasts could be made less objectionable if three sides of an octagon or hexagon than a square.



Automatic Bolt-Cutter.—See Page 1.

My impression is that 60 horse-power should be about the limit in size of boilers used, and if more power is wanted, double or triple the number. Twelve feet in height is the lowest that will do for the common tubular sort, and fifteen feet is better.

It is best to start the foundations around the boiler room down for that height, rather than start level with the balance of the building and undermine afterwards; and it is best to make room for four square feet of chimney flue for one boiler, six square feet for two, and eight square feet for three. How the coal is to be got to, and the refuse away from the boiler; where the water is to come from, where the pumps and heater are to set, and where the exhaust steam is to go, when not wanted for heating, are points to be considered.

In the beginning of the electric lighting business (which is scarcely more than ten years ago), there were so many things that we did not know, that poor lights were not always attributed to the proper cause. When the real cause was not known it was easy to fancy it due to the engine, and while only to a certain extent was this true, it led to the construction an d introduction of the high-speed small engine, because it was easier to properly govern a high-speed engine, and later because it seemed desirable to put electric light plants in places too small to admit the large motors. When it was supposed that more perfectly governed engines were a necessity, they were produced, and probably what constitutes proper governing, and how it can be accomplished, is far better understood than ten years ago; so that there are now quite a number of engines built that meet the requirements. Similarly the dynamos, lamps, and systems of wiring have been improved, and quite a number of companies are erecting plants that satisfy the demands of their customers.

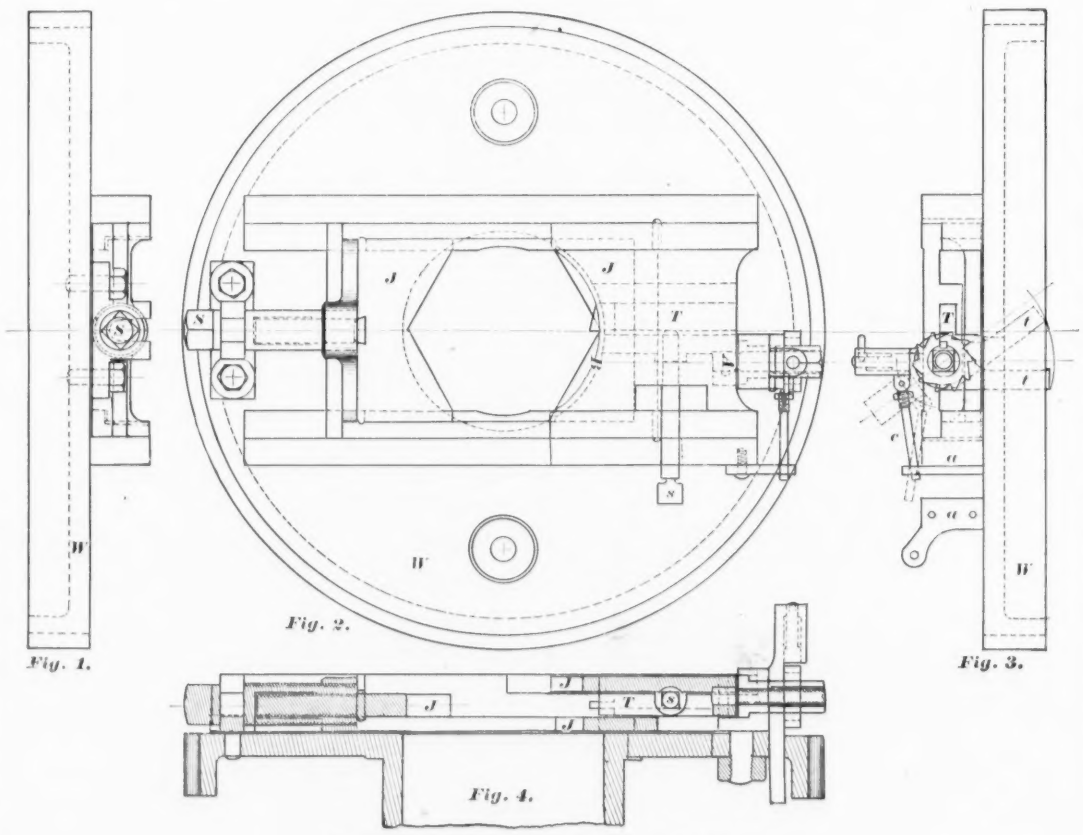


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

Pipe-Threading Machine.—See Page 1.

A first-class large slow-speed engine is more economical in steam consumption than a small high-speed one of the same power, but that is not claiming that all slow-speed engines are more economical than all high-speed ones, or that because an engine is more economical in steam consumption it is the most economical to use, for there comes in the question of first cost, the cost or value of the room it occupies, the cost of attendance, oil and repairs. Another point in electric lighting—the question of an engine always going when you expect it to—is of vital importance.

For nearly all isolated plants the small high-speed engine is almost a necessity on account of room, and in most cases the amount of power required is variable, for which reason a divided plant—that is, two or three boilers and two or three engines—is often more satisfactory than one large one.

Where two engines and two boilers will just supply the maximum demand, another boiler and engine practically duplicates the plant; with three there is always one in reserve, and with a divided plant, as the demand for lights falls off, one of the two engines may be shut down.

The engines and dynamo should be on the ground; for except by the most expensive provisions can they be put upon the upper floors and be satisfactory; and as the basement is the least valuable room and the best for the purpose, it is not good policy to cater to the notion that some have, that they would like to make a show-piece of their plant.

Making electric light is business, and it should be so considered. Many times it is necessary to put in a plant where the room is so short that the belt has to run back past the engine. This is bad, not only on account of the inconvenience and danger, but because it puts all the work on the upper half of the belt, allowing the lower half to sag away from the pulleys, reducing its driving power, and ends in its dragging on the floor and working badly.

For an isolated plant of from 250 to 800 incandescent lamps, a room from 25 to 35 feet in length should be set apart, if possible, and if for one engine and two dynamos, 12 or 18 feet in width will answer; if two engines, 16 to 25 feet, depending somewhat on the kind of engines and dynamos use .

Usually it is possible to get the advice of a competent boiler maker and engine builder when making the plans, whether their special product is used or not.

To what extent architects are consulted as to the selection of the various parts of a plant I do not know, but presume to some extent; and if so consulted, it stands them in hand to be prepared to give satisfactory replies, or at least avoid so far as possible making mistakes.

In regard to boilers, there are many new sorts, but mostly the new kinds are so tall as to be inconvenient in basements; this is a matter, of course, that always requires consideration, and sometimes condemns a boiler against other considerations of utility.

Tubular steel boilers, of the best material, moderate in size and properly set, are reliable and satisfactory. Kitts' or some other reliable high and low-water alarm, with a good safety valve, makes the boiler safe, if in the hands of a temperate, competent man. Either two pumps, or one pump and one injector, for feeding, are advisable. A good heater is such an element of economy that it should be included. Every pipe connecting either steam or water should have a stop valve and union in it. If two or more boilers, there should be a safety valve to each. If steam pipes are long they should be one size larger than the size the engine calls for, and thoroughly jacketed.

Boilers and engines vary in price, the same as clothing. If the low price is insisted upon, the maker is going to put in cheap stock and do poor work.

The man who furnishes the poorest of all is the man who offers the largest bribe, for the bribe is not coming out of his pocket. He is either going to take it out of the goods or out of your client; and though he may try to ease his conscience by calling it a commission, it is a bribe all the same. As it is always the best goods that command the best prices, so it is safe to conclude that the price

is a measure of quality. In many places quiet running of the engine and dynamo is essential, and, with noisy engines, various devices, such as sand bed or layer of cork, have been used; but the engines should run without noise, and the belts as nearly so as possible. There are other ways to drive without belts, that take less room and that ought to be less noisy. A cut gear with a leather (not rawhide) pinion, or the plan recently introduced of putting the dynamo pulley within about one-eighth of an inch of the engine pulley, and running a leather hoop between the two; I have known the latter device to work well in other places, and fancy it is feasible. But in laying out the room for a plant, it is best if possible to give the full length required for a belt, and this simply as a matter of economy.

As there are no restrictions, however severe, that will prevent an architect, if he has the genius, from making a good-looking building, so too with mechanics, all things are possible. But when special boilers, engines, or dynamos have to be designed and constructed to fit odd places, the cost is increased immensely.

To better understand why it is desirable to have the plant in the basement, it is only necessary to consider one or two of the difficulties encountered in high speed. In the hundred horse-power engines the weight of the reciprocating parts varies from one-fourth to a half ton. This weight has to be started and stopped from four to five hundred times a minute, and yet while reaching a maximum velocity of from 900 to 1,000 feet a minute. Or to consider it in another way, we have from 500 to 1,000 pounds weight starting from rest, and in going nine inches in the one-sixteenth part of a second, acquiring a velocity of 1,000 feet per minute, and then, in moving the next nine inches, is brought to rest; and to keep on doing this over and over for minutes, hours, days, and week after week silently, requires material, workmanship, and a foundation.

As action and reaction are equal, to start and stop this weight must bring a strain on the framing and foundation, were it not for counterbalancing, which is nothing more than putting an equal weight to the opposite side of the fly-wheel of the engine.

If this be correct, it will fully neutralize the shaking tendency which would otherwise be destructive to the building; but the counterweight does not obviate all the difficulties; for when the tendency to shake the engine frame endwise is fully neutralized, the same force has an equal tendency to shake the engine frame up and down.

On the upper floor it is hard to resist either tendency, whereas on the ground, one has the earth as an anvil, which seems best able of all things to stand it.

The danger of fire from the boilers can best be fortified against on the ground floor, and the tremble and noise from dynamos and belts are less troublesome.

It may be interesting, in this connection, to consider for a few moments the problem of engine regulation or governing. It is required of a machine capable of developing one or two hundred horse-power, that it shall make 150 or 200 revolutions per minute, and not go two turns slower if fifty per cent. more work be imposed upon it, and not over two turns faster in a minute if nine-tenths of the load be thrown off. This correction is accomplished by admitting more or less steam to the engine, which would seem simple enough, but remember it is to be done by a machine already in motion, and by itself.

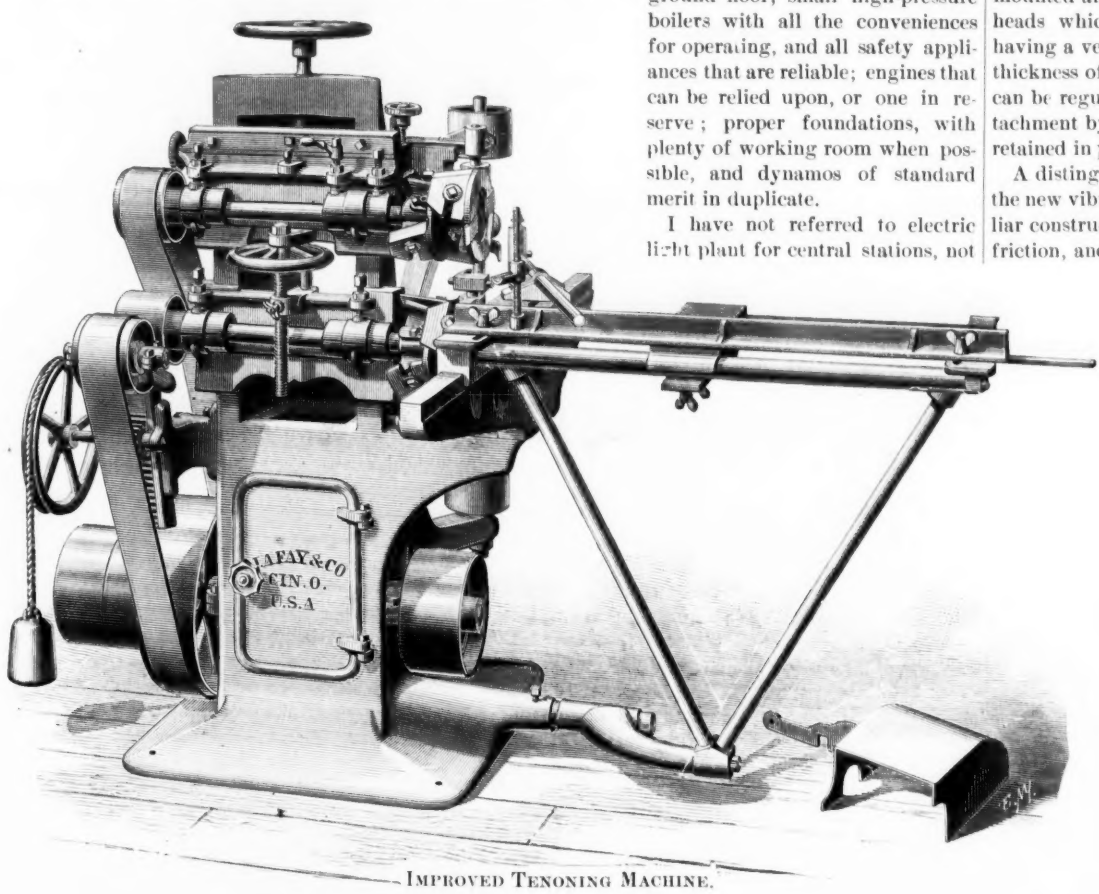
Were it possible to construct a valve steam-tight, that would move without friction and have no weight, the problem would be simple; but, as no such valve exists, the nearer one approaches it the easier the problem, and the more powerful the controlling mechanism and the freer it is from friction, the more nearly can perfection be approached.

The true test of governing is not the one usually employed—the general average of one minute with another, but the maximum velocity at any one instant of time compared with the minimum at any other instant.

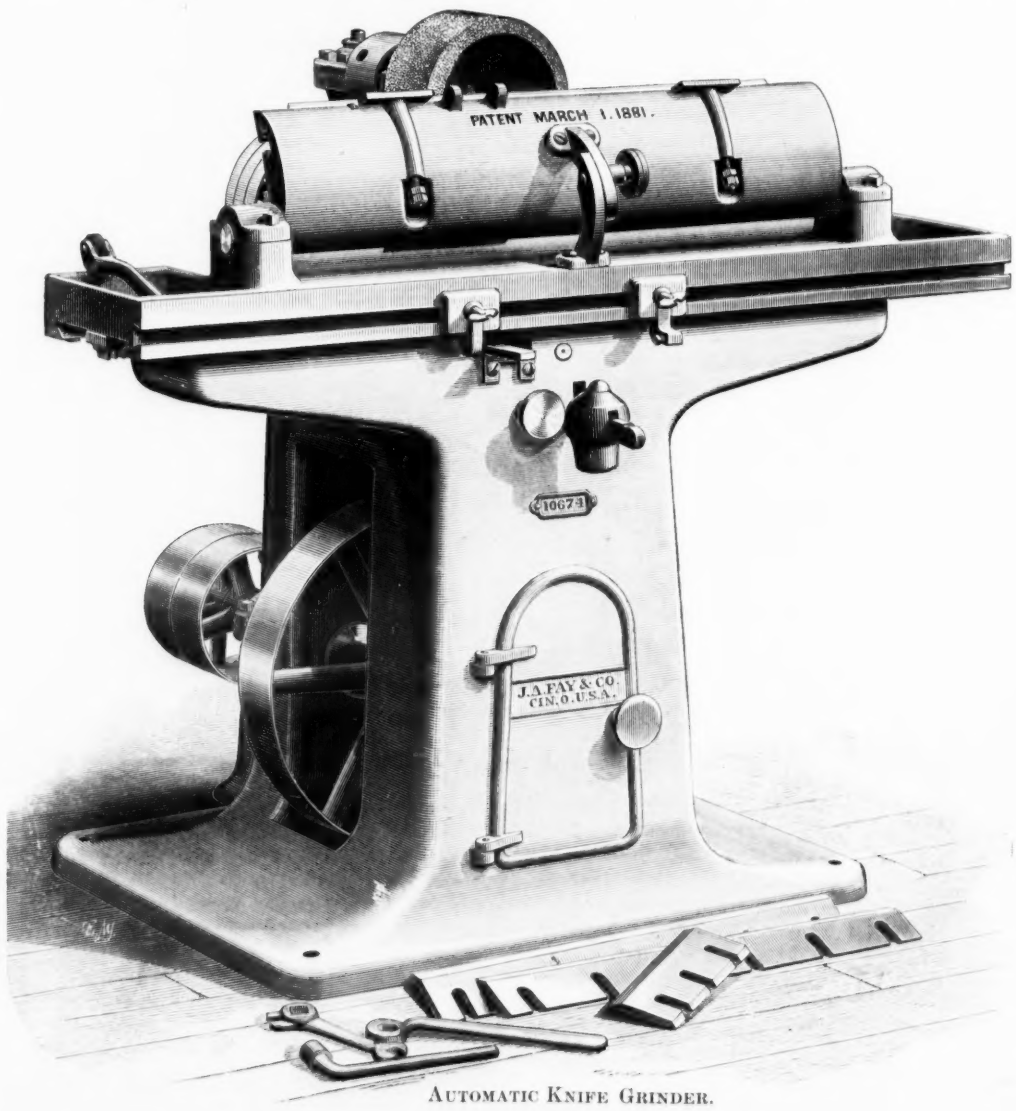
In conclusion, the isolated plant on the ground floor; small high-pressure boilers with all the conveniences for operating, and all safety appliances that are reliable; engines that can be relied upon, or one in reserve; proper foundations, with plenty of working room when possible, and dynamos of standard merit in duplicate.

I have not referred to electric light plant for central stations, not because it may not be of interest and value, but because it is a subject better understood by the electrical engineers.

After all, the location of the World's Fair depends upon the money subscribed.



IMPROVED TENONING MACHINE.



AUTOMATIC KNIFE GRINDER.

Improved Tenoning Machine—Automatic Knife Grinder.

Among the machines made by J. A. Fay & Co., which they have recently improved in design, are the two represented by the engravings on this page, the first of which is their door and sash tenoning machine. As will be seen, the machine consists essentially of a hollow square pedestal, upon which is mounted an upright, to which are gibbed the heads which carry the arbors, both heads having a vertical adjustment by which the thickness of the tenon or depth of shoulder can be regulated. There is also a lock attachment by which the heads can be securely retained in position when once set.

A distinguishing feature of this machine is the new vibrating carriage, which is of peculiar construction, and is so made as to reduce friction, and the consequent power required to work it, to the minimum. This carriage is gibbed too, and runs on a single slide, and connection is made from each end of it to a central pivot or crank at the bottom, which, as the carriage is moved back and forth, rolls or vibrates with little friction, and also enables the operator to follow up the work, there being no obstruction in his way. It is very light, yet is provided with all necessary stops, wrought-iron extension rod, poppets, springs, etc.

The copes can be adjusted separately if desired, though, being attached to the heads, no separate adjustment is required. The cope heads move in and out with single screws The usual form of spurs are replaced by saws, which are more easily kept in order, and require less sharpening. Owing to the angle and peculiar shape of the cutters, a drawing cut is obtained, which contributes much to the doing of smooth work. The bonnet is so arranged as to swing out of the way, to afford easy access to the cutters for sharpening.

The belt when once adjusted requires no attention, as a binder pulley, which is applied to the slack side, maintains an even tension at all times.

The second engraving is of an improved machine for grinding planer knives and cutters.

It is designed especially to meet the wants of planing mills, sash and door, moulding and box factories, agricultural shops, or wherever a reliable means is wanted to sharpen or grind cutters and knives.

The frame is of neat design, made in one solid casting of cored section, and has a large floor base. The machine is simple and substantial, easily taken care of, and for reducing cutters to a sharp, keen edge, has proven very effective.

It will sharpen planing knives of all kinds, up to 32 inches in length, giving them a true bevel and straight edge, or the machine can be changed when desired to grind the bevel edge of the knife a little concave.

For planing soft wood the best angle for the bevel is 25 degrees; for hard wood it should be increased. A cup wheel is used, as it grinds a flat surface, runs light, is easily kept trim, and is comparatively inexpensive.

The arbor is large, runs in connected self-oiling bearings, arranged to move forward as the wheel is reduced in size by wear. By moving the stops on the front face of the carriage it will traverse forward and back to any distance desired to suit the length of the cutter to be sharpened.

The knife-holder is very heavy, and trunioned on the carriage, and can be set to varying angles to suit the bevel to be made. The machine is automatic, and after being started requires no further attention, as it will continue to run until the knife is finished to a perfect edge, when the grinding ceases at the exact grinding point at which the stop may have been set.

As will be seen, the machine occupies less floor space than a grindstone; it grinds knives more quickly, and in a superior manner.

J. A. Fay & Co., Cincinnati, Ohio, are the builders.

A Handy Contrivance.

By Robert E. Masters.

The drawings show a combined heating stove, core oven and melting pot, used in the brass foundry of a large railroad system. *A*, Figs. 1 and 2, show a plain round heating stove, on a cast-iron bottom plate *B* (no legs are used). This stove was made of the usual style of large dome top heating stoves, used in roundhouses and depots. The dome section is left off, and the pipe connected at *C*, Fig. 2.

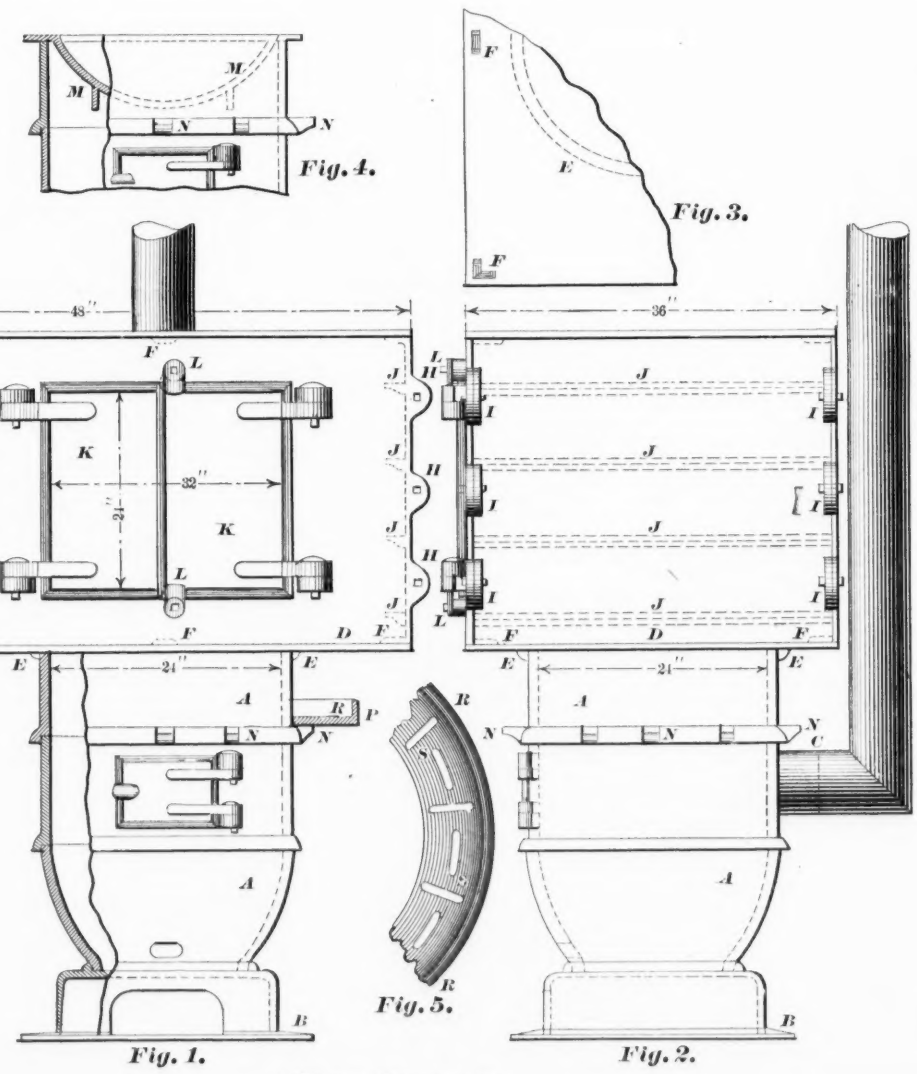
It is represented broken away to the right of Fig. 1, to show the inside arrangement. The bottom oven plate *D*, a top view of which is shown at Fig. 3, is cast with a circular rib *E* on the bottom side, to fit around the stove, to prevent sliding. The top plate can be cast from the same pattern, by stopping off the rib *E* in the mould. The angle and straight projections *F* are 1″ high, and act as a stay to the side plates. The top and bottom plates are not bolted to the sides. The lugs *G*, on the sides, are cast at right angles with the plates, and fit up against and are bolted to lugs *H* on front and back plates. An edge view of lugs bolted together is seen at *I*, Fig. 2. The brackets *J*, shown in section, and by dotted lines, are to support cross-bars, to set the core plates on. The doors *K* are of medium light wrought-iron, and are fastened when closed with buttons *L*. The back oven plate can be made from the pattern for the front plate by stopping off the lugs and cutting out the sand which forms the opening for the doors in the mould.

This oven has a capacity to dry cores for good size brass foundries on certain lines of work, and could be used to good advantage in many iron foundries where they have no core oven, saving the trouble and inconvenience of drying and watching cores on top of furnaces, and in and around boilers. The bars from the center shelves can be removed and a comparatively large core dried, besides utilizing the heat to keep the shop warm in winter. In the summer it could be removed outside of the foundry if desired.

Fig. 4 shows the oven removed, and the kettle *M* set in to melt the metal for lining journal brasses.

At the foundry referred to they make a large number of lead-lined brasses each month. The brass is placed in a former, and held secure by a lever worked with a pedal, the metal is dipped from the kettle and poured with a small babbitt ladle. The mixture of metal used for a lining at this place is 20 pounds of antimony to 80 pounds of lead.

The stove *A*, when used with a dome, has no hole for the stovepipe at *C*, the pipe connecting straight with the top of the dome. It is then used as a sand dryer by railroads having only a few locomotives. A number of projections, *N N*, are cast around the bottom of this section of the stove, for the ring shown in section at *P*, and in part plan Fig. 5, to rest on. A cylinder of heavy wire netting is placed on this, inside of the flange *R*. It is left open at the top and filled with sand over dome and all; as it dries, it falls readily through the slots *S* by starting it with a poker.



A Handy Contrivance.

Plug engineers employed in backwoods saw-mills are coming to the front as producers of boiler explosions. There are at least five times as many saw-mill explosions as locomotive boiler explosions, notwithstanding that the former comprises the largest class of boilers to be found in the United States. Poor boilers, incompetent engineers and no insurance makes a good combination for turning mill men into paupers or corpses in short order.—*Lumberman.*

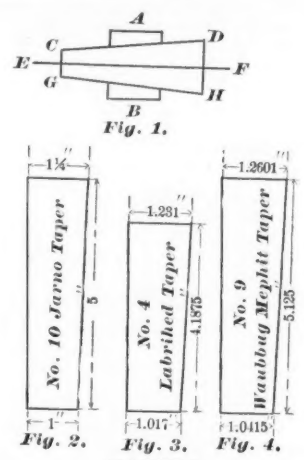
Again of Tapers—A System.

By Jarno.

It would appear that the condition of center tapers is even worse than was shown in the story of the cabinet. One maker has in his lathes ten different rates of taper.

Relatively, the obstacles in the way of changing to a standard have been overstated, because, for every one of these there is an equal or a greater obstacle in the way of continuing the confusion. Waubug asserts that to change now will cost more than all the profit that will ever come from having a uniform standard. The fact that he is the lathe maker having the ten rates of taper may have something to do with his so positive opinion. When made on purpose, has any one ever known of a change that did prove so costly? In a large concern there was a departure from the original standard, in consequence of making new gauges not particularly accurate and of gauges becoming worn. If it is easy to go away from one, it may not, with proper means, be hard to come to a standard. My cabinet acquaintance thinks that, ere long, he will alter or replace half the centers in his cabinet; and, at the same time, take along their spindles.

Is there a scientific principle involved in establishing a taper? There is this principle, that the angle of the taper must not be so large that a center will not stay, when driven in, and that the angle need not be so small as to make it very difficult to back the center out. These limits are quite indefinite. In Fig. 1 let the piece *A* rest upon the inclined surface *C D*. Now, the greatest angle that *C D* can make with the horizontal line *E F*, before *A* slides upon *C D*, is called the *angle of repose;* it has also been called the *limiting angle of resistance.* This angle varies with the material and the condition of the surfaces. The average angle of repose in metals having smooth surfaces that are oiled, is placed by Unwin at four and a half degrees, and by Willis at five degrees. Rankine gives the same, or a little smaller, angle as Unwin, and adds that in some experiments the angle has been as small as two degrees. Hence, it would appear that if *A* must slide, the angle of *C D*



with *E F* should be more than five degrees, and that if *A* must not slip, the angle should be less than two degrees. If *C D G H* be a wedge pressed between two pieces *A* and *B*, the law of its sliding will be the same as that just given, considering each of the two sides of the wedge to be at the same angle with its center line *E F* as we have just considered *C D* to be with *E F*. That is, if the wedge must slide when pressed upon by the two pieces *A* and *B*, the angle that one of its sides makes with the other side should be more than ten degrees, or more than twice the angle of repose. If the wedge must not slip, the angle of one side with the other, which may be called the angle of the taper, should be less than four degrees. Hence, we conclude that if a center be of a taper whose sides make an angle of less than four degrees, it is not likely to slip out, after being driven in, even though it be oiled. An angle of four degrees makes a taper of nearly seven-eighths of an inch to a foot. No center, so far as I have seen, has a taper more than this, which is interesting as indicating that the machinist, in practice, has not exceeded the angle of safety given in the text-books. Gascon says that the interesting thing is that the machinist knew by experience the angle of safety, long before it was recorded in books, though for it he had no special name, and that the books have merely followed the machinist. He says also that the quoting from so many authors looks too much like airing an acquaintance with their books. I reply that the quoting is done to show that it is not always safe to take any one author in a matter of experimental knowledge; the percentage of difference between two and five degrees is considerable. The limit to the smallness of the angle of taper is also indefinite. If a cold center be driven into a warm spindle, one might think that the center is not tapering enough, upon trying to back it out when the spindle is cold. The smallest center angle that I know is something less than two and a half degrees, which in practice has been found to be small enough. We are, therefore, at liberty to choose any angle of taper between two and four degrees.

I find that the best system is the following:

Let the rate of taper be one in twenty, or. 05″ *to* 1″*;*

Let the tapers be numbered 1, 2, 3, etc.;

Then the number of the taper is the number of tenths of an inch in diameter at the small end, the number of eighths of an inch at the large end, and the number of halves of an inch in length or depth.

Examples.—No. 1 is one-tenth inch at the small end, one-eighth inch at the large end, and half an inch long; No. 3 is .3″ at the small end, 3-8″ at the large end, and 1.5″ long.

Now we have a system in which a number means something; for when we know it we at once know the end diameters and the length. Let us look at a couple of examples of tapers in common use. Before me are six different lists; each of four of them purports to be a list of the same tapers. Neither of these four agrees with any other, and, of course, we cannot tell whether either is correct: confusion increasing—I write these words on the back of my hand, to make sure that I am not dreaming. I avoid the lists altogether, and select two tapers not in them, those of Labrihed and Mephit; their sizes are as given in Figs. 3 and 4. In thus giving correct sizes and real names of the makers, the reader that wishes to examine farther into this subject can have the benefit of my experience. In singling out Labrihed and Mephit, I would say that they are named not because they are pre-eminently bad, but because their tapers are known with some degree of certainty. The sizes in Figs. 3 and 4 can be easily carried in mind, if one has a good memory and nothing else to remember. Most persons cannot spare the time to learn a complicated system, and, therefore, they must consult drawings and tables in dealing with such a system. It gives one but little help to say that the length of a taper is four and five-eighths times the diameter of the large end, because one can consult a table as easily as make a calculation. In the Jarno system all the sizes can at once be derived from the number of the taper. Figs. 3 and 4 are in the vicinity of Jarno No. 10, Fig. 2. As soon as No. 10 Jarno is named, it is known that the small diameter is 1″, that the large diameter is 1.25″, and that the length is 5″. The length can also be derived from the diameter of either end: five times the small diameter, or four times the large diameter, is the length.

I do not expect that Waubug will change. Can any one tell why a boy plays marbles always in the first days of March when the ground shows up through the snow? Who ever can tell this, can tell why Waubug will not change. Perhaps he might, instead of our "Standard Taper," say our *tapers*, if the habit is not too firmly fixed. During the year 1890 some concern will start, be successful, and will be in existence fifty years from to-day. It is this concern, as well as others,

that shall start and be successful, in years to come, that will adopt the new system.

In the next paper I purpose to show a way of making and measuring gauges by which any one can conform and adhere to a standard.

Modern Locomotive Construction.

By J. G. A. Meyer.

ONE HUNDRED AND THIRD PAPER.

The pumps can be attached directly to the frames, as illustrated in Fig. 569, only in eight-wheeled passenger engines. In mogul, ten-wheeled, and consolidation engines there is no room to place them in similar positions, therefore, in the latter classes of engines, we often find them attached to the slides. Figs. 587 and 588 show a pump designed for fastening to the slide and yoke brace; the only difference between this pump and that previously shown is the position of the air chambers, and the position and design of the lugs. The type of slide for which this pump was designed is shown in Figs. 241. The lug near the stuffing-box (Fig. 588) is bolted to the top of the slide, and the lug near the air chamber is bolted to the yoke brace.

The illustrations (Figs. 587, 588) show the air chambers placed in the neighborhood of the center of the barrel; the object aimed at in this design is to concentrate the weight of the pump as much as possible near one of the points of support. As far as the distribution of weight is concerned, the design is correct; but in placing the air chambers at or near the center of the barrel, the direction of the flow of water is interfered with, which is an objection. The proper place for the air chambers, in the class of pumps here shown, is at the end of the barrel; and although they cannot always be placed there, it should be remembered that any change in the direction of the flow of water, such, for instance, as is caused by placing the air chamber in the center of the barrel, has a tendency to affect the efficiency of the pump, and this should be avoided as much as possible.

It may also be well to remark here that, in all pumps, the suction valve should be placed as near as possible to the plunger, leaving only a sufficient water-way between them. Necessary changes in the form and size of the water passages should be made gradually; sudden enlargements and contraction should always be avoided.

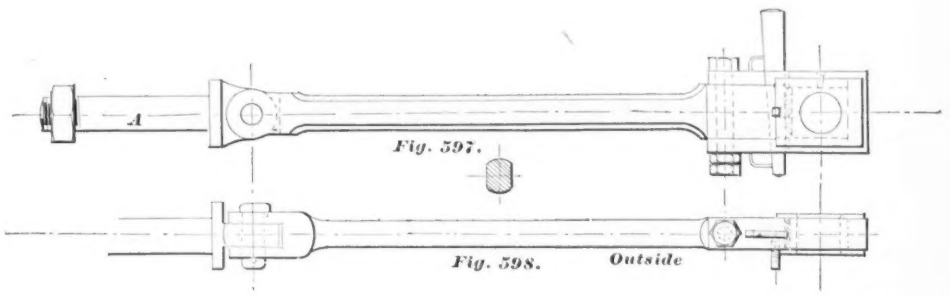


Fig. 597.

Fig. 598. Outside

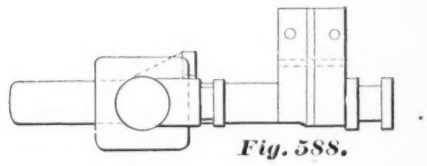


Fig. 588.

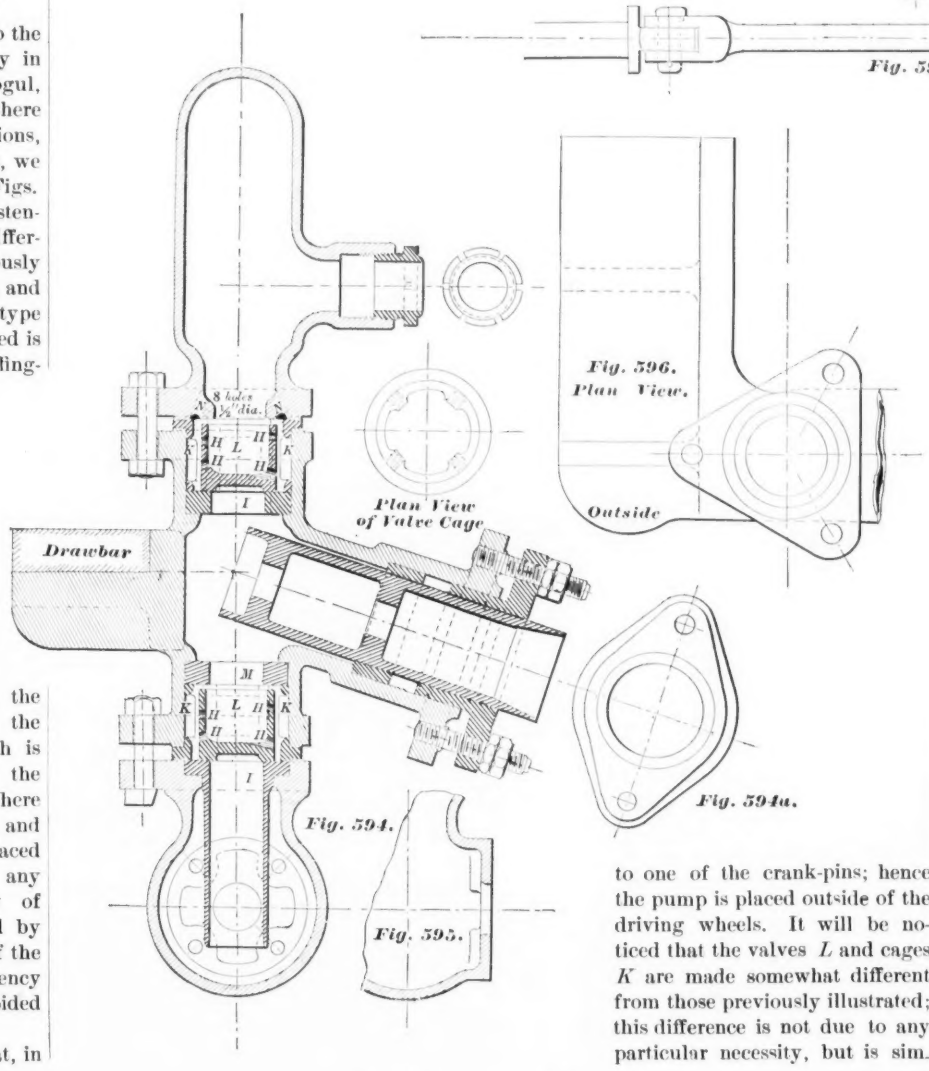


Fig. 596. Plan View.

Fig. 594. Fig. 594a. Fig. 595.

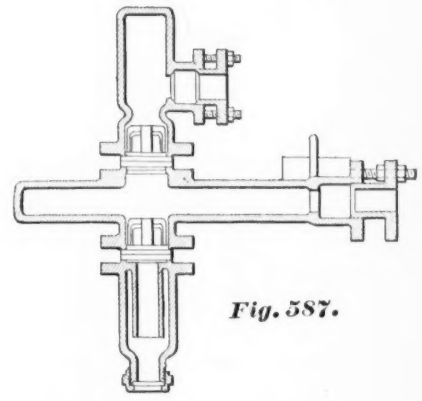


Fig. 587.

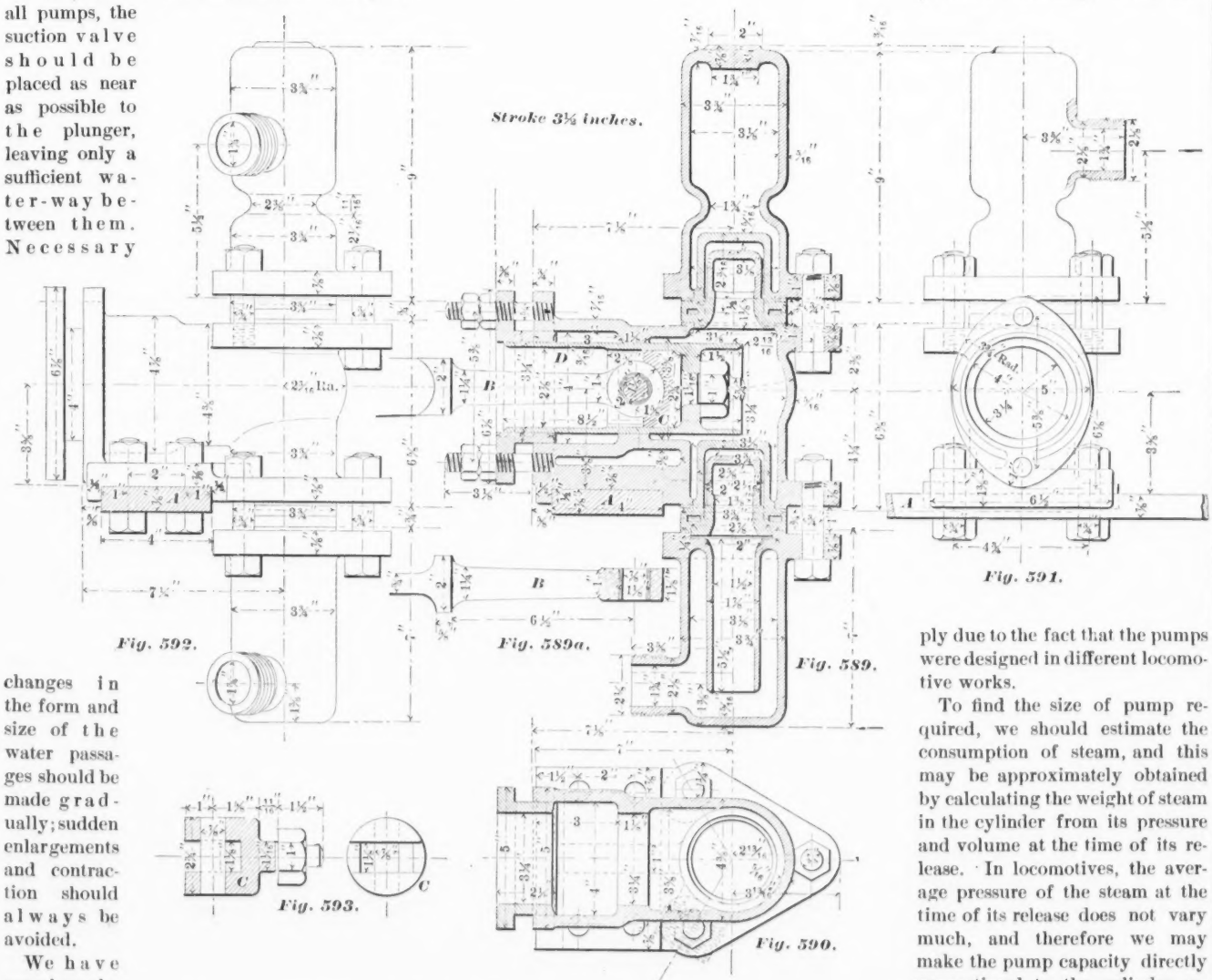


Fig. 592. Fig. 589a. Fig. 589. Fig. 591.

Fig. 593.

Fig. 590.

We have previously referred to short stroke pumps; sections and other views of this class of pumps are here given in Figs. 589 up to 592. These pumps are illustrated. This pump is designed for a 12-inch cylinder.

Figs. 594 up to 596 represent another short-stroke pump. The pump is fastened to the draw-bar, and is worked from a pin attached to one of the crank-pins; hence the pump is placed outside of the driving wheels. It will be noticed that the valves *L* and cages *K* are made somewhat different from those previously illustrated; this difference is not due to any particular necessity, but is simply due to the fact that the pumps were designed in different locomotive works.

To find the size of pump required, we should estimate the consumption of steam, and this may be approximately obtained by calculating the weight of steam in the cylinder from its pressure and volume at the time of its release. In locomotives, the average pressure of the steam at the time of its release does not vary much, and therefore we may make the pump capacity directly proportional to the cylinder capacity, without finding the amount of steam consumed. Since the stroke of a full-stroke pump is equal to that of the piston in the steam cylinder, we may further simplify the computation and make the cross-sectional area of the plunger directly proportional to the cross-sectional area of the cylinder. Practice indicates that for locomotives having two pumps, good results will be obtained by making the cross-sectional area of each plunger equal to $\frac{1}{12}$d of the cross-sectional area of one cylinder. This proportion is not strictly adhered to by the different builders; indeed, many builders use the same size of pump for two or three different sizes of cylinders; for instance, the pump illustrated in Fig. 568 is used for cylinders 16, 17 and 18 inches in diameter. But the proportion here given we believe to be a good one to adopt in designing a full-stroke locomotive pump. Hence the following:

Rule.—Divide the cross-sectional area of the cylinder by 72; the quotient will be the cross-sectional area of the pump plunger for locomotives in which two pumps are to be used.

Example.—What should be the diameter of the pump plungers for a full-stroke pump in a locomotive having cylinders 17 inches diameter?

The cross-sectional area of a cylinder 17 inches diameter is 226.98 square inches, and $\frac{226.98}{72} = 3.15$ square inches for the cross-sectional area of the plunger; the diameter of a circle containing 3.15 square inches is two inches (very nearly), hence the diameter of the plunger should be two inches.

Let us take another example. Find the diameter of the pump plungers for a full-stroke pump in a locomotive having cylinders ten inches diameter. Here we have $\frac{78.54}{72} = 1.09$ square inches for the cross-sectional area of the pump plunger, and the diameter will be $1\frac{3}{16}$th, nearly.

In a similar manner we find that the diameter of the pump plungers for full-stroke pumps for cylinders 20 inches in diameter will be nearly $2\frac{3}{8}$ inches. These results agree very closely with the average locomotive practice.

The capacity of a full-stroke pump designed by the foregoing rule will be $\frac{1}{7\frac{1}{2}}$d of the capacity of one steam cylinder; and short-stroke pumps should have the same capacity. We may, therefore, establish the following:

Rule.—Multiply the cross-sectional area of the cylinder in square inches by the length of stroke of piston in inches, and divide the product by 72; the quotient will be the capacity of the pump in cubic inches. Dividing this capacity by the length of stroke of plunger in inches, we obtain the cross-sectional area of the plunger in square inches;

or, dividing the capacity of the pump by the cross-sectional area of the plunger, we obtain the stroke of plunger.

Example.—Find the diameter of the pump plunger; its stroke is 7 inches; the diameter of the steam cylinder is 18 inches; stroke, 24 inches.

The cross-sectional area of the steam cylinder is 254.47 square inches; hence its capacity is

$$254.47 \times 24 = 6107.28 \text{ cubic inches,}$$

and

$$\frac{6107.28}{72} = 84.82 \text{ cubic inches for the capacity of the pump.}$$

Dividing the capacity of the pump by the stroke of plunger, we have

$$\frac{84.82}{7} = 12.11 \text{ square inches for the cross-sectional area of the plunger; and its diameter will be } 3\tfrac{5}{6} \text{ inches nearly; hence we may say that the diameter of the plunger should be four inches.}$$

Suppose that in the foregoing example the diameter—four inches—of the plunger had been given instead of the stroke, and that it is required to find the stroke of the plunger. Under these conditions we proceed in the following manner:

We first find the cross-sectional area of a plunger four inches diameter, which is 12.56 square inches; now, dividing the pump capacity by 12.56, we have $\frac{84.82}{12.56} = 6.75$ inches, which is the stroke of the pump plunger. These results agree closely with the size of the pump illustrated in Fig. 594, which is an exact copy of a working drawing; the diameter of the plunger is 4 inches; stroke, 7 inches; this pump was designed for 18x24 inch cylinder.

Example.—Find the diameter of a short stroke pump plunger, whose stroke is $3\frac{1}{2}$ inches, the locomotive having cylinders 12 inches in diameter, stroke 20 inches.

The capacity of the steam cylinder is $113.10 \times 20 = 2262$ cubic inches. That of the pump should be

$$\frac{2262}{72} = 31.41 \text{ cubic inches;}$$

and the cross-sectional area of the plunger will be

$$\frac{31.41}{3.5} = 8.97 \text{ square inches;}$$

and its diameter will be $3\frac{3}{8}$ inches, nearly. Here, again, we have results agreeing closely with dimension in Fig. 589, which is also a copy of a working drawing.

Of course the fact of using only one pump and an injector for the same locomotive will not make any difference in the sizes of pumps found by the foregoing rules.

LETTERS FROM PRACTICAL MEN.

Lathe Centers.

Editor American Machinist:

Jarno has given us a good article on lathe centers and their variability. The thought, no doubt, will come to many, why, instead of making collets to fit the centers, they did not bore and ream the center holes and make new centers, the cost of which would not have been much greater than the cost of the collets. Probably the reply would be that there is great difficulty in making a center hole true in that way, and this calls up the following suggestion:

Make the right number of collets of steel—hardened and ground inside and out, parallel outside—and then bore out the lathe spindles parallel, and force in the collets to stay.

The second advantage of this plan would be that the man who bores out the center hole periodically would make less headway.

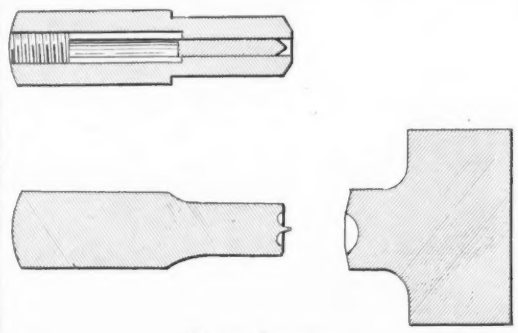
I expect this has been done as a remedy for a mutulated spindle, but suggest it as a way to accomplish uniformity in a place where uniformity is desirable.

JOHN E. SWEET.

Rivet Setting.

Editor American Machinist:

In your issue of Sept. 26th an article on riveting appears, which calls for some criticism. The writer appears to advise the use of the automatic riveting hammer for light work, whereas, it has been proven that the correct principle on which to set a rivet is by means of compression. Hydraulic, steam, and lever riveting machines, with one single exception, use that system, and for light work, such as the writer describes, a simple punch and die are the most efficient tools that



RIVET SETTING.

can be used. The great difficulty in riveting is to get the end to expand without enlarging the neck. In using a hand hammer you can turn the edge over, and thus make a good set, but you cannot make a machine do that perfectly, as it must strike a direct blow on the end, and the rivet being of the same strength throughout, it is inclined to expand in the neck, causing the work to buckle. To obviate this difficulty is the problem. Now, if we can produce a tool which will exert its force in a direction at right angles with the pressure, we have what we want. This can be done by using a chisel, or center point of an angle of 90°. If the work is rough, a chisel set in a socket slightly larger than the rivet, and with a regulating screw at the back, will do very well; but if the work is to be finished, a center point with a cupped shoulder, as shown in the drawing, is the best. By regulating the press carefully, the rivet can be set tight or loose, as desired. The other advantages are that all the rivets, hard or soft, long or short, have to "get there all the same," and the cost is a mere trifle compared with a machine. I have used a punch and die of this description on rivets as large as $\frac{5}{16}$" diameter, and got excellent satisfaction. The drawing annexed shows the construction of these tools.

HENRY LONG.

A Note About Index Plates.

Editor American Machinist:

I recently constructed a piece of mechanism, which involved differential gearing, the gears to have 99 and 100 teeth respectively. The milling machine I have (a Brown & Sharpe universal) will not cut 99 teeth when the index head is manipulated in the ordinary way, unless a plate is made with a circle of 99 holes drilled in it, which is not a good plan if you can avoid it, as the holes in such a plate would come very close together. I found, however, that the job could be done by moving the index crank *forward* one turn, and 6 holes on the 27 row, and *backward* 27 holes on the 33 row. This gives a forward motion to the crank of $\frac{38}{27} - \frac{27}{33} = \frac{40}{99}$, which is what is required to cut 99 teeth in the gear. This, perhaps, may be a familiar idea to many milling machinists, but to others it may be new, and for their benefit I append a table showing some of the divisions with their corresponding moves that may be made by this method, but which the regular way will not admit of.

WALTER GRIBBEN.

Number of Teeth.	Forward Move.		Backward Move.	
69	$\frac{24}{23}$		$\frac{11}{33}$	
77		$1\frac{5}{21}$		$\frac{22}{33}$
87	$\frac{23}{29}$		$\frac{11}{33}$	
93		$1\frac{3}{31}$		$\frac{22}{33}$
96	$1\frac{3}{16}$		$\frac{15}{30}$	
99		$1\frac{6}{27}$		$\frac{27}{33}$
105	$1\frac{1}{21}$		$\frac{22}{33}$	
138		$\frac{22}{33}$		$\frac{22}{33}$
147	$\frac{13}{39}$		$\frac{7}{10}$	
154		$\frac{13}{21}$	$\frac{11}{33}$	$\frac{15}{33}$
186	$\frac{17}{51}$			
198		$1\frac{5}{27}$		$\frac{22}{33}$
225	$\frac{14}{18}$		$\frac{12}{28}$	
231		$\frac{10}{21}$		$\frac{16}{33}$
253	$\frac{17}{23}$		$\frac{11}{33}$	
273		$\frac{26}{39}$		$\frac{26}{39}$
276	$\frac{11}{23}$		$\frac{11}{33}$	
287		$\frac{21}{41}$		$\frac{25}{43}$
288	$\frac{7}{16}$		$\frac{5}{20}$	
294		$\frac{28}{42}$		$\frac{22}{33}$
297	$\frac{22}{27}$		$\frac{22}{33}$	
304		$1\frac{6}{16}$		$\frac{16}{20}$

Force, Motion and Work.

BY PEDRO.

FIFTH PAPER.

In the last paper we studied uniformly accelerated motion as starting from a state of rest. Now let us see what the laws of the motion are when the body is already in motion at the beginning of the time from which it is considered. For example, let Fig. 6 represent the diagram of this motion. The time $t = B\,C$, during which the motion is considered, begins at the end of a certain time $A\,B = t_1$, at which time the velocity of the body is $B\,D = V_1$. The body moves a certain length of time t, at the end of which its velocity is $C\,E = V_2$.

Now it is evident that the mean velocity during the time t is $\frac{1}{2}(B\,D + C\,E)$ or $\frac{1}{2}(V_1 + V_2)$, hence, by Rule 1, second paper, the space passed over in the time t is

16 ..... $s = \frac{1}{2}(V_1 + V_2)\,t.$

Or, if $F\,E = V$ is the velocity gained during the time t, then the mean velocity is also equal to $(V_1 + \frac{1}{2}\,V)$, or to $(V_2 - \frac{1}{2}\,V)$, hence we also have

17..... $s = (V_1 + \frac{1}{2}\,V)\,t.$

18..... $s = (V_2 - \frac{1}{2}\,V)\,t.$

The velocity, V, gained in any time t, is, as we have seen by equation 11, fourth paper,

$$V = a\,t.$$

Substituting this value in equations 17 and 18, we have

19 ..... $s = V_1\,t + \frac{1}{2}\,a\,t^2.$

20..... $s = V_2\,t - \frac{1}{2}\,a\,t^2.$

When the motion is given in terms of the initial and final times t_1 and t_2, the time of motion, t, to be used in the preceding formulas is found by subtracting the former from the latter, viz.:

21..... $t = t_2 - t_1.$

Applying equation 12 (III.), fourth paper, we have

$$s_1 = \frac{V_1^2}{2\,a} \text{ and } s_2 = \frac{V_2^2}{2\,a},$$

and knowing that $s = s_2 - s_1$, we have

22..... $s = \frac{V_2^2 - V_1^2}{2\,a}.$

Collecting these equations under one head for convenience of reference, we have

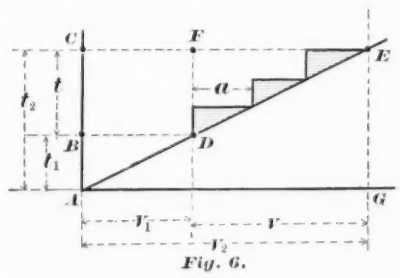


Fig. 6.

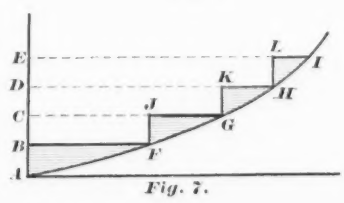


Fig. 7.

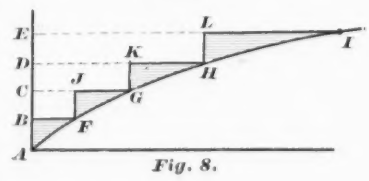


Fig. 8.

23 {
I..... $s = \frac{1}{2}(V_1 + V_2)\,t.$
II..... $s = (V_1 + \frac{1}{2}\,V)\,t.$
III..... $s = (V_2 - \frac{1}{2}\,V)\,t.$
IV..... $s = V_1\,t + \frac{1}{2}\,a\,t^2.$
V..... $s = V_2\,t - \frac{1}{2}\,a\,t^2.$
VI..... $s = \frac{V_2^2 - V_1^2}{2\,a}.$

These formulas will answer the question, What is the *space* passed over by a body having a uniformly accelerated motion when there is given

I.—The initial and final velocities and the time.

II.—The initial velocity, the time and the velocity acquired during the time the motion is considered.

III.—The final and the acquired velocities, and the time.

IV.—The initial velocity, the time, and the acceleration.

V.—The final velocity, the time and the acceleration.

VI.—The initial and final velocities, and the acceleration.

Let one example suffice under this head. Suppose a car breaks loose from a train in going up a grade, and that it runs down grade with an acceleration of 150 feet a minute. At two points along the track are men who observe the speed of the car as it passes them, the first one being 500 feet and the second 1,500 feet a minute. Now, what is the distance between the two points at which the men were stationed? From equation 23 (VI.), we have

$$s = \frac{1{,}500 \times 1{,}500 - 500 \times 500}{2 \times 150} = 6{,}666\tfrac{2}{3} \text{ feet.}$$

Other examples will readily suggest themselves to the student if he desires to study the subject thoroughly.

How can we find the initial velocity V_1? Solving equations 23 (I., II., IV. and VI.), we get

24 {
I..... $V_1 = \frac{2\,s}{t} - V_2.$
II..... $V_1 = \frac{s}{t} - \frac{1}{2}\,V.$
III ..... $V_1 = \frac{s}{t} - \frac{1}{2}\,a\,t.$
IV..... $V_1 = \sqrt{V_2^2 - 2\,a\,s}.$
From 23 (V. and VI.)
V..... $V_1 = V_2 - a\,t.$
From diagram, Fig. 6
VI..... $V_1 = V_2 - V.$

Example.—Suppose all the data of the example under equation 23 to be known, except the initial velocity—at the first station—what is that velocity? Equation 24 (IV.) is applicable, which gives

$V_1 = \sqrt{1{,}500 \times 1{,}500 - 2 \times 150 \times 6{,}666\frac{2}{3}} = 500$ feet a minute.

What is the final velocity V_2? From equation 23 (I., III., V. and VI.) we get

25 {
I..... $V_2 = \frac{2\,s}{t} - V_1.$
II..... $V_2 = \frac{s}{t} + \frac{1}{2}\,V.$
III..... $V_2 = \frac{s}{t} + \frac{1}{2}\,a\,t.$
IV..... $V_2 = \sqrt{V_1^2 + 2\,a\,s}.$
From 24 (V. and VI.)
V..... $V_2 = V_1 + a\,t.$
VI ..... $V_2 = V_1 + V.$

Example.—Using the same data as before, what is the final velocity of the car—at the second station?

From 25 (IV.) we have

$V_2 = \sqrt{500 \times 500 + 2 \times 150 \times 6{,}666\frac{2}{3}} = 1{,}500$ feet a minute.

What is the time of motion? From equations 23 (I., II., III., IV. and V.) we get

26 {
I..... $t = \frac{2\,s}{V_1 + V_2}.$
II ..... $t = \frac{2\,s}{2\,V_1 + V}.$
III..... $t = \frac{2\,s}{2\,V_2 - V}.$
IV.. $t = \frac{\sqrt{2\,a\,s + V_1^2} - V_1}{a}.$
V.. $t = \frac{\sqrt{V_2^2 - 2\,a\,s} + V_2}{a}.$
From 25 (V.)
VI .. .. $t = \frac{V_2 - V_1}{a}.$

Example.—In case of the car, how long did it take the car to run from the first to the second point at which the men were stationed?

From 26 (VI.)

$$t = \frac{1{,}500 - 500}{150} = 6\tfrac{2}{3} \text{ minutes.}$$

To find the acceleration of the motion we solve equations 23 (IV., V. and VI.), which give us

(27)

I ..... $a = \frac{2}{t}\left(\frac{s}{t} - V_1\right).$

II..... $a = \frac{2}{t}\left(V_2 - \frac{s}{t}\right).$

III..... ...$a = \frac{V_2^2 - V_1^2}{2\,s}$.

From 23 (II. and VI.)

IV.....$a = \frac{V_2^2 - V_1^2}{(2\,V_1 + V)\,t}$

From 23 (III. and VI.)

V ..... $a = \frac{V_2^2 - V_1^2}{(2\,V_2 - V)\,t}$

From 26 (VI.)

VI..... $a = \frac{V_2 - V_1}{t}$.

Example.—Having found the time in the previous example, what is the acceleration, supposing this to be unknown? Equation 27 (VI.) gives

$$a = \frac{1{,}500 - 500}{6\frac{2}{3}} = 150 \text{ feet a minute.}$$

UNIFORMLY RETARDED MOTION.

All the previous equations of this paper are applicable to uniformly retarded motion when V_2 is considered the *initial* and V_1 the *final velocity* (the terms being reversed from those of accelerated motion) and a as the *retardation* instead of the acceleration.

For example, take the speed of a train at 45 miles an hour, or 3,960 feet a minute, when the brakes are applied. Suppose the retardation to be uniform, then how long will it take to bring the train to a standstill within a distance of 495 feet? In this case the initial velocity $V_2 = 3{,}960$ feet, the final velocity $V_1 = 0$, and the space passed over is 495 feet: hence, from equation 26 (I.), we have

$$t = \frac{2 \times 495}{0 + 3{,}960} = \tfrac{1}{4} \text{ of a minute.}$$

Example 2.—What is the retardation of the train? From equation 27 (III.) we have

$$a = \frac{3{,}960 \times 3{,}960 - 0 \times 0}{2 \times 495} = 15{,}840 \text{ feet,}$$

or three miles a minute.

MOTION WITH VARIABLE ACCELERATION.

When the motion is not uniformly accelerated it may be represented, generally, by a diagram like Fig. 7 or Fig. 8, in which the time is measured from A along the vertical line, as A B, the first minute, B C the second, etc. The acceleration is

B F for the first minute,
J G for the second minute,
K H for the third minute,
L I for the fourth minute, etc.

It will be seen that no two of these are alike, the acceleration being variable as well as the velocity. Fig. 7 represents a *decreasing acceleration*, while Fig. 8 shows an *increasing acceleration*. General rules cannot be given for this class of motions. In any particular case the law of the variation is usually given in terms of the distance passed over, or the cause which produces the motion, etc.

Forced Draught.

BY W. H. BOOTH.

Under the head of chimney suction, reference has been made to forced draught.

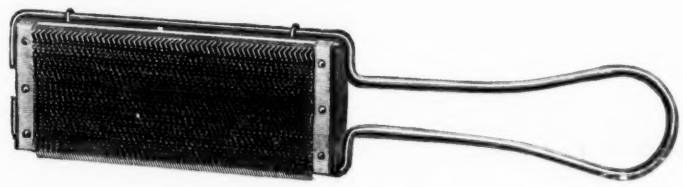
It may seem a very simple matter to expedite combustion by using a fan to urge the fire, but there are many practical difficulties to be overcome in making a forced draught economical in practice, as it appears to be theoretically. A novice, seeing the brilliant appearance of the fuel on a grate under a fan-blown draught, is apt to imagine that so high a temperature cannot fail to be productive of economy, and yet this may be by no means the result. A fan draught to a thin fire, or, indeed, to any fire, has a keen cutting action; wherever the bed of fire is specially thin, weak or open is a point of attack for the inflowing air. If such weak places be watched they will be observed to glow more brightly than other parts, the glowing fuel rapidly melts away, streams of air form small volcanoes, and finally the fire grows so thin that many jets of air come through the grate without ever making contact with fuel, and escape to the chimney unaltered chemically, but bearing away a load of heat uselessly absorbed. This gives rise to enormous losses in efficiency, and can only be properly guarded against by the adoption of fires of sufficient thickness. In some recent experiments the continued agitation of a narrow band of the fuel on a grate—an agitation by no means violent, but sufficient merely to preserve a weak place in the fuel bed—rendered it impossible to preserve a fully covered grate, for the air supply quickly cut through at this line of weakness, and opened up so wide a strip of bare grate as to allow air to pass in great volume, the immediate result being very sluggish combustion on the remaining covered surface of the grate.

The fire thickness must then be so thick that no volcanoes can form in a reasonable period after firing. Many stokers are never content unless they are constantly raking and stirring the fire, to do which calls for an open door, with corresponding inrush of cold air and chilled plates. The practice is most reprehensible, and should not be necessary. It is usually an accompaniment of thin fires, and rendered necessary by such thinness. With thicker fires holes are less readily formed, and more liable to be partially self-closing, from the fall into them of fuel from the walls of the hollow parts. Now a very thick fire under a forced draught will burn a much larger amount of coal per square foot than an ordinary thin fire, and to some extent, though advocated in foregoing papers, a small grate area is a disadvantage. There is little doubt in the minds of most practical men that the best work of a boiler furnace is that which is performed directly by the incandescent fuel; that is, by the direct radiation from the burning mass on the bars. In a short grate this area is reduced, though the thickness of the fire, and therefore its radiating area in actual contact with the plates—we are here speaking of internally fired boilers—is increased, though its upper surface is diminished more than the side or edge surface is augmented. The thicker and shorter fire, too, is hotter, and so radiates more heat; but it is a fact that very frequently stokers find it easier to manage a long fire, and undoubtedly this must be largely due to the great efficiency of the incandescent fuel as a heat radiator, but length of fire ought not to be secured by a sacrifice in thickness, as fuel is thereby wasted. In soft coals there is a great difference in specific gravity of the burning fuel. Some coals lift under the draught more readily than others, and call for a greater fuel depth; others, like American hard coal, appear far better capable of burning economically in thin layers than would be expected.

In locomotive practice the fire-box is often filled two and three feet deep in fire, and burning into holes can hardly occur under such conditions. Speaking generally, economy in the use of air, which is strictly economy in fuel also under good management, can only be secured by proportioning the thickness of the fire to the intensity of the air pressure. Unless this be done, the constant necessary leveling and raking will undo much or all of the benefits of better combustion.

Many of the mechanical stoker makers in England content themselves with air spaces several fold less than the area of bars, and base this practice on the fact which they state is a fact, that, with a fire constantly sprinkled with coal, the air supply needs to be constant and uniform, and sufficient finds its way through even the narrow spaces allowed between the bars to give complete combustion, the fires being thin and always evolving hydrogen gases on their top surface, which utilize the surplus air coming through the thin fire. Though so far we have argued against thin fires, we would not overlook the fact that, with a good reliable fuel sprinkler, if one can be found, an occasionally fairly perfect action is attained by them; giving an evenly laid fire a thin fire with small air spaces need not necessarily be wasteful with a moderate draught. Forced draught, however, cannot be applied to thin fires; for these, when once burned into holes, would remain so, as the air pouring in through the thin or bare parts would prevent the descent on such parts of any fresh fuel, and so cause increased thickness of the thick areas, and complete demoralization of the whole furnace. Therefore, though moderately forced draughts seem likely to grow in use, special precautions are needed in their application, and, unless such precautions are used, an amount of air will pass uselessly to the chimney, which will completely vitiate all economy properly due to better combustion. The necessity of a thick fire is greater in the simple fan draught than in the closed stokehold system; for the probability is that the difference of pressure above and below the fire will be greater, and the tendency to formation of volcanoes will be increased thereby. A disadvantage attending forced draught is the liability to form a glowing furnace in the ash-pit of the unconsumed fuel falling through the bars. This is liable to cause disaster to the fire-box through overheating, and has been overcome in some cases by fitting a water-tank below the bars, to quench all falling cinders. The bars are made deep, and dip into the water at their lower edges, and so keep cool, and are less liable to adhere to the clinker.

Those who wish to examine the state of their fires at the back ends—a matter of difficulty with flaming and smoky coal—should use a tube through which to look. A three or four-inch tube, long enough to reach through the fire and out at the door, enables a clear sight to be obtained at any part of a fire. Locomotive men know this, but it is not well known to stationary firemen, and yet it is well worth knowing, as it will show up a bare back grate where sometimes little suspected.



IMPROVED FILE CARD.

Improved File Card.

An improvement in machinists' file cards is represented by the accompanying engraving. The back, to which the card is attached by metallic strips at each end, is surrounded by a wire, which is so formed as to constitute a handle, which will not split or break. The carding is made of steel wire, and is superior to the commoner kinds in use. It is furnished by Frasse & Co., New York city.

Some mistakes occurred in the figures given regarding the contemplated enlargement of Bement, Miles & Co.'s shops at Philadelphia. These mistakes are corrected, and some additional figures and facts given by them as follows:

Length of entire shop on Callowhill street, 495 feet. The extension at the east end will be 145 feet long by 85 feet wide. Of this width, 60 feet will be used for erecting tools, and the heavy handling will be effected by a 30 ton Sellers traveling crane, which will have a clear lift of 35 feet. The present shop, continuous with the new one, will be widened to 75 feet for a distance of 300 feet, and in the widened portion there will be two 20-ton traveling cranes with a high lift, also for erecting. In addition to the 145-feet extension there will be another shop, standing at right angles, 106 feet long by 85 feet wide, having an erecting space 60 feet in width, with another 30-ton Sellers traveling crane to lift 35 feet high. The galleries will be 25 feet wide instead of 15, as stated.

The Locomotive reports 16 boiler explosions during the month of August. Of these, four were saw-mill boilers, four threshing engines, one (failure of a tube) a locomotive boiler, one in a nail factory, one in rolling-mill, one in a brewery, one in a stave factory, one in a planing mill, one in a pleasure boat and one in a coal works. From this it will be seen that the saw-mill boiler is barely holding its own. A month or two later, however, it will be able to give the thresher points.

Alfred B. Ropes.

Alfred B. Ropes, who will be remembered by the readers of the AMERICAN MACHINIST as an occasional contributor to its columns, died recently at Sacramento, Cal.

Mr. Ropes was a young man of excellent ability, and his future prospects were particularly bright. Graduating at Stevens Institute about five years since, he saw the necessity of a practical knowledge of whatever branch of engineering he was to follow, and, having a strong inclination for railroad work, he lost no time in securing a position at the bottom of the ladder, which he was rapidly climbing when he was taken sick.

From the time he first began railroad work, young Ropes worked with a zeal that steadily pushed him ahead, and bade fair to bring him to the front in railroad matters.

The writer had the pleasure of advising with him as to his future course before he left the Institute, and has heard from him at frequent intervals since he entered upon his railroad life. Everything has tended to impress him with the belief that young Ropes was one of the most earnest and intelligent workers in his line, and that he was destined to make his mark in his chosen profession. Socially, he was courteous in his intercourse with men, securing the esteem of all he came in contact with. A great many friends, among whom the writer desires to be counted, sincerely regret the death of Alfred B. Ropes.

The comments of one of our New York papers on the number of gold medals awarded at Paris to our American exhibitors is not justified by the facts in the case. It seems to have been taken for granted that, because the exhibit from this country was not, as a whole, or as a national exhibit, satisfactory or fairly representative of American industries, therefore no individual exhibits from this country were creditable, and that the numerous gold medals awarded to American exhibitors simply show that the French were too courteous to send us away empty-handed.

So far from this being the case, it is undoubtedly true that, of the lamentably meager American exhibits, most of them were of the highest degree of excellence, and would not have been improved in character in the least had the collective American exhibit been an hundred times as large as it was. The result, so far as medals go, has been foreshadowed in our foreign technical exchanges, a large share of their space having been devoted to illustrations and descriptions of American machinery shown there. Of the five grand prizes awarded to machine tool builders, two came to this country, which is no more than might be expected, when it is considered the awards were made upon such tools as Wm. Sellers & Co's. latest improved planers and tool grinders, and the Brown & Sharpe milling machines, and other tools, etc.

Rapid as are the advances made in mechanical and engineering science, it is well for those connected with these departments of human achievement to reflect that progress must needs be rapid if other professions are to be left behind. In surgery, for instance, a recent writer in *Harper's Monthly* gives figures, which show that the deaths resulting from major amputations have been reduced from over 50 per cent. to something less than 4 per cent., this reduction in the proportion of fatal cases being thought to be chiefly attributable to the introduction of the use of antiseptics in surgical operations. It is claimed that the practice was first broadly used in our own Philadelphia, though it is now common throughout the world.

Geo. A. Walker, for the last four years general manager for the Union Stone Co., of Boston, has entered the employ of the Springfield Glue and Emery Wheel Co.

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CONTENTS.

	PAGE.
Pipe-Threading Machine	1
The Adams Automatic Bolt-Cutter	1, 2
Steam Plant for Isolated Electric Lighting Purposes. By Prof. John E. Sweet	2, 3
A Handy Contrivance. By Robert E. Masters	4
Again of Tapers. By Jarno	4
Modern Locomotive Construction. By J. G. A. Meyer	5, 6
Letters from Practical Men: Lathe Centers. By John E. Sweet—Rivet Setting. By Henry Long—A Note About Index Plates. By Walter Gribben	6
Force, Motion and Work. By Pedro	6, 7
Forced Draught. By W. H. Booth	7
Improved File Card	7
Alfred B. Ropes	7
Trials of New Naval Vessels	8
Cheap Living	8
Literary Notes	8
Questions and Answers	8, 9
Manufactures	9
Machinists' Supplies and Iron	10

Trials of New Naval Vessels.

Some time since we said that a test of the new naval cruiser, The Baltimore, had shown that she possessed a horse-power capacity far beyond the contract requirements, and that a handsome premium would be paid to her builders on account of it. A subsequent test was made, however, and the first report from it was to the effect that the first performance had been still further exceeded, this report being afterwards contradicted by the statement that the cruiser had failed to develop the horse-power required by the contract, and that a penalty would probably have to be paid. It is now announced that a third official trial is to take place, and, of course, a result differing from all the others is to be expected.

These reports have come in the form of dispatches from Washington, which are published in the newspapers, and we are now convinced that no reliance whatever is to be placed in them, and, moreover, that no reliable and satisfactory information can be obtained before the publication of the official report of the Navy Department, if indeed it can be anticipated that that report will be in every way entirely satisfactory.

At Cramps' no information whatever can be obtained, and the test of the cruiser is in effect a secret one, no one who, in a broad sense, represents the people being allowed on board during the run. The naval officers and the representatives of the builders are present; no one else is permitted to be there. We do not wish to appear hypercritical in these matters, but we think it would be more satisfactory for the people who pay for these new vessels, if competent engineers not connected either with any shipbuilding yard or with the Navy Department were allowed aboard at the time of making trial runs.

It is probable that things are all straight enough, but so many utterly conflicting reports, and so many different tests with such widely different results, are calculated to set people to thinking, and all the more when the trials are, to all practical purposes, secret ones.

Cheap Living.

The Department of State has issued a report made by the U. S. Consul at Glasgow containing an account of a remarkable school designed to teach the wives of workingmen the art of cheap cookery—how to make soups out of kidneys and livers and the heads of codfish. A large number of recipes for cheap dishes are included in the report, and it is thought they may prove useful in "certain crowded districts of the United States."

Now, while we do not doubt that the sending of this report by our Consul, and its publication by the State Department, have been with the best intentions—with a real desire to assist poor people in the struggle of life, we respectfully submit that such things can do little if any good, and that to expect measures of extreme economy on the part of working people to prove a panacea for all their troubles, as many seem to expect, is utter folly. It has been said that "the rate of wages is fixed by the standard of wages set for himself by the workman," and to a considerable extent this is true. If all workingmen could be convinced that codfish head soup at a cost of six cents per day per family was the best possible thing for a workingman's table, then those who were out of work, and seeking it, would not consider that the lowest possible limit of wages had been reached, so long as the amount offered would admit of an indulgence in codfish head soup. And instead of the workmen saving the difference between the cost of their present living and the codfish heads, wages would tend towards an amount just sufficient to purchase the heads. Economical living may be of advantage to the individual, or to the few, but when it becomes general, and all the members of a class economize, the economical style of living becomes the standard of living, and he who would save must economize still more, the end of this coming when no individual can possibly go further in economizing than the entire class have already gone. And it is readily seen that the saving effected by extreme economy of living on the part of workmen, resulting in a lower standard of wages, does not go to the employes as such, for competition between different producers of the same or similar goods constantly tends to reduce the price to that amount above the cost of production, which will induce men to continue in the business, so that if the reduced wages result in reduced cost of product, competition will in the end force a corresponding reduction in selling price, unless prevented by monopoly.

An employer may be also a monopolist, in which case he may reap some of the rewards of his workmen's economy; but it will be by reason of his being a monopolist, not as an employer simply. In the end, those who are able to control special privileges or monopolies of some kind will pocket the entire proceeds of the economy of working people, where that economy is not exceptional, but general.

We might go on and point out the fact, that, when the cheapest possible fare had been determined and universally adopted, the materials composing it would almost inevitably rise in price, while those displaced by them would fall in price, making a new bill of fare necessary. If everybody ate codfish heads, leaving the rest of the fish, the heads would soon bring the higher price, and it would be necessary to furnish recipes for dishes made from other, and perhaps less inviting materials. Experience in the older countries shows, however, that working people can be taught, or can teach themselves, to live upon the poorest and cheapest fare, leaving all the more desirable things to be enjoyed by those who do little or nothing towards their production; but when that condition of affairs prevails here, if it ever does, the self-respect and ambition of our working people, upon which we pride ourselves so much, will be gone, and with it the strength of our Government and institutions. It is a sadly significant thing that a department of our Government considers that there is need for instructing a large class of our citizens, who hold the destiny of the country in their hands, how to live on the cheapest, poorest and most miserable substances to be found, when at the same time the country is overflowing with the best of everything, and nature stands ready to yield a yet greater abundance in return for labor applied to her resources. Cheap living makes cheap men and cheap citizens, and it will be better to turn our efforts in the direction of finding a means whereby those who produce our national wealth may enjoy it, each one in proportion to his production.

Some one suggested, at one time, that it would be a good thing if technical schools were to cease giving diplomas. Wouldn't it be an equally good thing in its way if the managers of great fairs ceased giving gold medals? Awarded, rather than giving, is the word, for we believe that every recipient of a medal is obliged to pay for it. We have seen a statement of the number of gold medals that would be required to go around amongst the exhibitors at Paris; we cannot just now recall the number, but it is sufficiently high to suggest plentifulness in the future. Since they are used so promiscuously as to be of no further value than what they are worth for bullion, we respectfully suggest to the management of the next world's fair—we mean the one to held in 1892 at New York, Chicago, Washington or St. Louis—the propriety of taking into consideration the running of one fair without gold medals.

It is courteous to show the representatives of the South and Central American States over the country as is being done. While they know in the main what we produce here that the countries they represent want, it is a good thing that they see something of the country for themselves. But, in building up hopes of extensive sale of our products in the South and Central American States, it will never do to lose sight of the fact that, in the main, we must buy as much of the product of these countries as they buy of ours. It appears sometimes to be assumed that all this country needs is plenty of steamship communication with the two other Americas to build up, forthwith, an immense trade. Better steamship communication would be an excellent thing, but this alone will not solve the problem. It is just as necessary to look about to the end of seeing what we are to buy in South and Central America as it is to see what we can sell there. Unless the terms we make with them are as good as they can make in Europe, there would be but little trading if there were forty steamship lines.

There is a good deal of check in the demands sometimes made by parties upon towns as inducements to the location of industrial establishments. The figure, at present, appears to be about $200,000 in cash, along with sundry other privileges; at least that is the figure that a town recently refused to pay for the privilege. When people get wiser, we believe towns in their corporate capacity will cease to give anything for such purposes except good will and fair dealing.

Literary Notes.

A DICTIONARY OF ELECTRICAL WORDS, TERMS AND PHRASES. By Edwin J. Houston, A. M., Professor of Natural Philosophy and Physical Geography in the Central High School of Philadelphia, Professor of Physics in the Franklin Institute of Pennsylvania, Electrician of the International Electrical Exhibition, etc.

No one who is in any way connected with mechanical or engineering matters can have failed to realize the need of a dictionary of electrical terms.

The marvelous progress of electrical science has necessitated the coinage of many words, terms and phrases, which a few years ago were entirely unknown, and which those who do not make a special study of the science have had no means of acquiring an accurate knowledge of. This work will in all probability be recognized as a standard authority, and will fill an important place. It contains 640 pages, profusely illustrated, and it is evident that much conscientious labor has been bestowed upon it, and no pains spared to make it thoroughly useful. The definitions are made sufficiently full to be entirely clear, and an elaborate system of cross references has been introduced, which makes it as easy to find a definition when the word to which it applies is unknown. The work will probably become recognized as a necessity in the libraries of mechanics, engineers and scientists. It is published by The W. J. Johnston Co., L'd, New York. Price $2.50.

The Engineering and Building Record for Oct. 19 comes to us with a cover of a distinctively red color. This gives the paper four more pages, being an enlargement to the extent of the cover. *The Engineering and Building Record* is standard authority in its line, and it is a pleasure to note this evidence of its prosperity.

Questions and Answers

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(400) J. H. S., Chattanooga, Tenn., will find an answer to his question in our issue of Oct. 17.

(401) F. A. F., Woonsocket, R. I., writes: Please inform me how to select good India ink, and how to mix it so that flies will not eat it. I would like ink that is water-proof, and at the same time not injurious to the pen. I have a stick of ink supposed to be first-class, but the flies eat it about as fast as I can put it on the tracing, and the slightest moisture of the hand causes a smutch where the hand touches it. I have tried various liquid inks, but have failed to find one that gave a

good black line on tracing cloth. *A.*—See article headed "Test of India Ink," in the issue of last week.

(402) J. R. R., New York, writes: I am getting out cams for special work. In your articles on drawing, has anything appeared that will assist me in my work? *A.*—The subject of cams has not yet been taken up in the drawing articles. In our issues of June 23 and July 7 you will find very interesting articles treating on laying out cams, by Prof. A. T. Wood.

(403) J. C. R., New York, writes: Will you kindly inform me how to begin the study of steam engineering (locomotive)? I am a stenographer, and am employed during the day. I would like to study it during the evenings. Also give the name of a good book—if there is any—giving the full details on the construction and the operation of the locomotive. *A.*—We believe that the articles on Modern Locomotive Construction, now running in the AMERICAN MACHINIST, will give you the full details of construction. The Catechism of the Locomotive, by M. N. Forney, and the Management and Running of the Locomotive, by Angus Sinclair, are also good books to study.

(404) C. R. K., Watertown, N. Y., writes: Please give me a simple rule for finding the points on a safety valve lever to hang the ball at any desired pressure. *A.*—Let L represent the distance from center of fulcrum to the center of ball or weight; B, the distance from center of fulcrum to center of valve spindle; A, the area of the safety valve opening; P, the steam pressure in pounds per square inch; W, the weight of the ball; W_2, the weight of the safety valve and its spindle; W_3, the weight of safety valve lever; C, the distance from the center of fulcrum to the center of gravity of the safety valve lever. All dimensions to be taken in inches, and weights in pounds. We then have the following formula:

$$L = \frac{(P \times A \times B) - (W_2 \times B) - (W_3 \times C)}{W}.$$

(405) J. W. G., Norwalk, Conn., asks: How can I instruct myself in arithmetic, fractions in particular, without a teacher? *A.*—We see no other way than for you to procure a good elementary arithmetic, and study it until you do understand it. It is often advantageous to procure two arithmetics written by different authors, presenting the subject in different styles of language, which may often enable you to discern more readily an analysis, and help you to overcome some apparent difficulty. 2. How can I learn to read mechanical drawings when I have no chance to work from them? *A.*—It seems to us that, if you carefully study the articles on Practical Drawing now running in the AMERICAN MACHINIST, you will soon be able to read mechanical drawings. 3. Where can I get a catalogue of machinists' tool chests? *A.*—Apply to any first-class hardware dealer.

(406) J. R. G., Forrest City, Pa., writes: I wish to make a press for pressing light car wheels on axles. I have made a single-threaded screw of fine pitch, so as to get the power, and could not keep the threads from stripping. I now wish to use a double screw, that is to say, one inside of the other; please give me the dimensions of the outside and inside screw, also the pitch of the same. *A.*—It would have been more satisfactory if you had given us the pressure with which the wheels are to be pressed on the axles; as it is, we can only assume a pressure—we have taken 18 tons. Outside diameter of inner screw, 2 inches; square thread; pitch, ⅛ inch. Outside diameter of outer screw, 3¼ inches; square thread; pitch, ⅝ inch. The length of the screws will depend on the length of the hub of the wheel which is to be pressed on the axle; this dimension you have not given; make the lengths of the screws as short as you can conveniently get along with. Make screws of soft steel.

(407) Reader, ———, N. Y., writes: I am designing an engine for road traction purposes, whose dimensions are as follows, subject to change on your suggestion. Single cylinder, 9 inches diameter, 12 inches stroke; making 250 revolutions to 2¼ miles per hour on the road. Steam ports, ¾x8½ inches; exhaust port, 1½x8½ inches; bridges, 1 inch wide; common slide valve; 3-inch travel, governed by a link of the regular type; width of valve, 5⅝ inches, giving $\frac{1}{16}$-inch lap on each end; inside lap $\frac{1}{16}$ inch. Lead in full gear, about $\frac{1}{32}$ inch, which, of course, will be increased as the link is hooked up towards the center. I intend using a dry pipe for steam about 8 feet long from dome to smoke-box turned up to top of dome, with drain hole in bottom of vertical pipe about ⅜ inch in diameter; this pipe is to be 3 inches diameter, then reduced to 2½ inches outside of smoke-box to cylinder, which is quite close. The exhaust pipe I intend making 3 inches, going through a small heater, then into the stack to increase draught reduced to 2¼ inches. The boiler is to be 42 inches diameter, return tubular horizontal with 320 square feet of heating surface, 12 square feet of grate surface. One 18-inch main flue then returned through 38 flues 3 inches diameter. What diameter and length would you have the smoke-stack? Crank-shaft is a center crank with balance, 3½ inches diameter, wrought-iron; crank-pin, 3 inches diameter, 3 inches long. Connecting rod, 36 inches between centers. Kindly look over these figures and correct them. *A.*—The smoke-stack we should make about 9 inches diameter, and about 5 feet high, provided there are no bridges or other obstructions preventing this height. The given dimensions of the engine are very good, and we do not see that any change will improve it. The given length of the valve, we suppose, is simply a mistake; no doubt you meant to write 6⅝ instead of 5⅝ inches. We have some doubt as to the utility of the heater; it should be kept in mind that, in cooling the exhaust steam, it may lose the required amount of heat for increasing the draught, and under these conditions a smaller exhaust nozzle may be required, which, in turn, will increase the back pressure in the cylinder. It is also advisable to construct the exhaust pipe so that its area may be varied by inserting short thimbles. 2. How many horse-power should the engine develop with 100 pounds boiler pressure? *A.*—We should estimate its average indicated horse-power at 48. 3. How many horse-power should it require to move the engine along, say it weighed 10 tons, or 20,000 pounds, in stubble ground, at the rate of 2¼ miles per hour, with and without the friction of the engine and machinery? The two driven road wheels are 8 feet diameter, 24 inch face, with cleats to take hold of the ground. Front wheels 4 feet diameter, 10 inch face; these wheels are not driven. *A.*—It is extremely difficult to compute, even approximately, the power required to move the engine on stubble ground, since the power will depend on the nature and condition of the ground. Assuming that the traction is 600 pounds per ton, then it will require about 36 horse-power to pull the engine on leve ground at the given rate of speed; this, of course, will include some of the friction of the engine, and it may develop about 42 horse-power in propelling itself at the given rate of speed.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.

Gear wheels and g-cutting. Grant, see adv., p. 16.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc., J. B. Roney, Lynn, Mass.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co , cor. Fulton and Dutch sts., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

Ice and Refrigerating Machines, 131 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

"How to Keep Boilers Clean." A 96-page book mailed free by Jas. E. Hotchkiss, 120 Liberty st., N.Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Prestoline & Prestoline Paste, for cleaning & polishing metals. S. A. Smith, 23 S. Canal st., Chicago.

Iron Planers from 16″ to 36″ wide by any length. H. C. Pease & Co., Worcester, Mass.

R. G. Du Bois, 715 11th St., Washington, D. C. Procures first class patents on inventions. Write.

For the latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Send $1 for Catalogue D, Fine Tools and Supplies. Over 550 pages. Fully illust'd. Free when $10 worth goods are ordered. Frasse & Co., 92 Park Row, N. Y.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See Oct. 24, p. 12. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

For Portable Key-seating Machines and Stub Ends for small connections, address T. C. Dill Machine Co., 726 Girard ave., Philadelphia, Pa.

The "Handy," "Smith," "Diamond" and "Favorite" Screw Plates are manufactured by S. W. Card & Co., Mansfield, Mass.

25″ Upright Drills a specialty. Finely made,
28″ great capacity, quickly operated, prices low.
32″ Send for list of firms using our Drills. J. E.
36″ Snyder, Worcester, Mass.

The Holly Manufacturing Company, of Lockport, N. Y., will send, on application, their pamphlet illustrating pumping machinery and reports of duty trials.

Eureka Cotton Machine Belting; a cheap and perfect substitute for leather or rubber belting. Address Eureka Fire Hose Company, 13 Barclay st., New York, for prices and samples.

25″ } "Only Drill Press built on
32″ } 'Ko-rekt' principles,
37″ } even if they come from Jersey."
42″ } Gould & Eberhardt, New Ark, N. J.

Steam Boilers: Their management and working on land and sea. By Jas. Peattie. Practical facts from 30 years' experience. 230 pages. Illustrated, 12mo., cloth, $2. Circulars and Catalogue of Books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N.Y.

Barnard's Separator, for Separating and Removing Entrained Water from Live Steam, and Condense Water, Oil, Dirt, etc., from Exhaust Steam. Special Design for Surface Condensers. Send for circular and prices. Geo. A. Barnard, 15 Cortlandt st., New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patents, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

H. B. Roelker, 22 Cortlandt st., New York, late Sup't Delamater Iron Works, will hereafter manufacture the Delamater Screw Propeller. Propellers of same pattern and workmanship as formerly made by the Delamater Iron Works. Each designed for its special work at lowest prices. Consulting Expert and Constructing Engineer. Estimates made on machinery and on damages.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including October 10, 1889 issue, 87 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 101 articles have thus far appeared up to and including the October 3, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada, at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

The cotton gin of E. T. Kenney, at Dawson, Ga., was recently burned.

F. W. Puryear will build a planing and shingle mill at Sheffield, Ala.

C. S. Brown will build a carriage factory, 80x250 feet, at Carrollton, Ga.

It is said that the car works at Rotterdam, N. Y., will start up with 200 men.

Whitman & West will build a saw-mill for oak lumber at Cumberland, Md.

James Armstrong & Sons are building a knitting factory at Charlottesville, Va.

The foundry and machine shop at Fort Dodge, Ia., were recently destroyed by fire.

The Johnson City (Tenn.) Foundry and Machine Works will place some new tools.

The Western Weighing Machine Co. has been incorporated at Chicago, Ill., with $25,000 capital.

The Illinois Central Railroad Co. will buy considerable new machinery for their shops at Durant, Miss.

The Jefferson Lumber Company will rebuild their planing mills, recently burned, at Kildare, Texas.

The Grosse Pointe Water-Works Co. has been incorporated at Grosse Pointe, Mich. Capital stock $30,000.

Theodore Miller is interested in a $50,000 stock company that will build a shingle mill at Jacksonville, Fla.

The Morrill-Stevens Engineering Company is putting new tools in its machine shop at Jacksonville, Fla.

The Wilkin Manufacturing Co., Milwaukee, Wis., are building a new foundry, and will build a machine shop.

The Iowa Rolling Mills, Burlington, Ia., will be rebuilt, the new buildings being materially larger than the old ones.

A foundry for the manufacture of mining, hoisting and furnace machinery, will be established at Eagle Pass, Texas.

John Shellenbeck & Sons are erecting works to be known as the Progressive Foundry and Machine Shop, at Joplin, Mo.

Charles N. Smith has organized a stock company to manufacture carriages, at Danville, Ky. Works will be erected at once.

Thomas J. McDermot, of Biddeford, has bought the Rockland, (Me.) Brass and Iron Foundry, and will enlarge and operate it.

The Moore Manufacturing and Foundry Co. will build a new foundry at Milwaukee, Wis., and will increase the size of machine shop.

The United States Butter Extractor Company has just started an extensive factory in Newark, N. J., for manufacturing the Johanson butter extractors.

The Alpha Iron Works, Montreal, Canada, has been incorporated, with a capital stock of $50,000, for the general manufacture of articles of iron, steel and brass.

Thos. H. Dallett & Co., Philadelphia, Pa., have issued a circular of the Billberg electric motor, which the firm manufactures. It is made in sizes from ⅛ to 25 horse-power.

A large tannery will be built at Bucksport, Me., by a syndicate represented by George Blodgett. The old steel works, with several acres of land, has been purchased, and work has already been commenced.

Nicholson & Waterman, Providence, R. I., have recently increased their works by the addition of a new pattern shop, 50x100 feet. This change will also considerably increase their machine shop facilities. They write us that they are crowded with work.

Ground has been broken for the large new pulp mill at Basin Mills, Me. The mill is to stand on the point of the island just below the present lumber mills at the basin, and will necessitate bringing the branch of the Maine Central Road there by the railroad company.

The West Superior Iron and Steel Co., Wes-Superior, Wis., are contemplating extensive additions to their works. Their foundry, 72x360 feet, is being fitted up to make cast-iron pipe; a new furnace will be built, and it is intended to add a steel-making plant.

The cutlery grinders who struck some time ago at Warner & Sanderson's shops, Greenfield, Mass., are putting their money and labor into a new shop that is being erected there. It is said that members of the grinders' union will join this co-operative concern, and that it will have a good financial backing.

William H. Smith, of Springfield, Mass., will put up a brick building opposite his carriage factory in that city. The new building will be an addition to the present factory, and will be a three-story brick front, with stone trimmings. It is to be 62 by 30 feet, making the dimensions of the entire building 150 by 30 feet.

The White Manufacturing Company of Rockville, Ct., manufacturing ginghams, is to increase its capital stock $50,000, making the total $220,000. Much of the old machinery is to be displaced by new and improved machinery, and many new cards are to be added, which will largely increase the capacity of the mill.

It is reported that a steel plant, to cost $1,000,000, will be built at Youngstown, Ohio. Among the iron manufacturers interested in it are the Andrews Iron Company, the Trumbull Iron Company and the Ohio Iron and Steel Company. Henry Wick, of the last-named company, is now in Europe, visiting the numerous steel plants, and upon his return the coming month, the erection of the plant will be commenced.

The Butler (Pa.) Salt and Manufacturing Co. is fully organized, $100,000 of the capital being already paid in. It is proposed to build a plant covering nearly four acres. Sixteen boilers will be used for furnishing steam. The company will manufacture salt, cromine, muriatic acid, sulphate of soda and carbonate of soda, wood alcohol, acetate of lime, acetic acid, creosote and bi-sulphide of carbon, coal gas and carbolic acid.

There is water-works agitation at Marshall, Minn.; Kilbourn City, Wis.; Valdosta, Ga.; Scribner, Neb.; Clerburne, Texas; Union, S. C.; Bryan, Texas; Vernon, Texas; Peoria, Ill.; Meriden, Conn.; Northwood Narrows, N. H.; Manchester, Iowa; Lakeport, Cal.; Loup City, Neb.; Barnum, Col.; San Bernardino, Cal.; Enterprise, Ore.; Liberty, Va.; Paris, Ill.; El Paso, N. M.; Fergus Falls, Minn.; Calville, Wash.; Puyallup, Wash.; Santa Cruz, Cal.

The National Machinery Co., Tiffin, Ohio, has issued a very complete catalogue of bolt and nut machinery, and machinery for making wire nails, rivets, spikes, washers. This company has made a specialty for several years of bolt and nut machinery, and supply manufacturers with complete outfits. In addition to illustrations and descriptions of a large number of machines, the catalogue contains several tables that mechanics will find useful.

The Bucyrus (Ohio) Foundry and Manufacturing Company, among the largest and best known builders of steam excavating machinery in the United States, are very busy, running night and day. Last year the company added $12,000 worth of heavy tools to their plant, built a new erecting shop for heavy work, 180x45 feet, fitted with overhead traveling cranes and all the modern improvements, and sold and shipped 48 steam shovels and 16 dredges, many of them very large machines, besides a large number of railroad wrecking cars and other machinery of various kinds.

The Hall Steam Pump Co., No. 91 Liberty street, New York, are fast completing large and well-equipped machine shops and foundries for manufacturing, on an extended scale, the Hall duplex steam pump and power pumping machinery, that have met with such remarkable success in the past few years. The new works are located at Pittsburgh, Pa., in one of the best districts for cheap fuel and iron, and very central for shipments. As they have been unable for several months to accept all orders placed with them, they will doubtless have their large works well filled with orders from the start.

The village of Mechanic Falls [Me.], since the beginning of the year, has enjoyed an uninterrupted season of prosperity. The six paper mills of the Poland Paper Company, as has also their large pulp mill at Gilbertville, have been run at their full capacity, and at the present time the only complaint that is heard is that they are too crowded with orders. Joseph Harris & Sons' shoe factory are turning out at least four times the work ever before in the same length of time. J. A. Buckman & Co. have increased their business of manufacturing clothing so that their workingmen and women, at the factory and at their homes, are numbered by the thousand. And all the smaller industries, which are not a few, are enjoying the same good fortune.—*Industrial Journal.*

Machinists' Supplies and Iron.

NEW YORK, Oct. 26, 1889.

Iron—American Pig Prices have an upward tendency, though there is no scarcity of supplies We quote Northern brands, No. 1 X Foundry, $17.50 to $18.50; No. 2, $16.50 to $17 50 Southern brands, No. 1, $17.25 to $17.75; No. 2, $16.50 to $17. Northern brands, Grey Forge, $15.50 to $16. Southern brands, $15.50.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 80 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Traveling salesmen to sell our machine specialties. The Brightman Mach. Co., Cleveland, O.

Foundry foreman, 17 years' exp., desires position. General machinery preferred. Box 37, AM. MACH.

Wanted—Experienced mech. draftsmen. The Baltimore Sugar Refining Co., Curtis Bay, A. A. Co., Md.

Competent agents wanted to represent a meritorious & paying steam specialty. Business, AM. MACH.

Wanted—Two experienced tool makers. The E. Ingraham Co., Bristol, Conn.

Position wanted by a graduated mech. draftsman with shop exp. Address J. C. N., AM. MACHINIST.

A sup't to pump factory, employing 300 hands, is open to engagement. Address "Z.," AM. MACHINIST.

Wanted—Position by reliable mech draftsman. Draft'g or office work. Excell't refs. Box 41, AM. MACH.

Wanted—Competent draftsman on engine work. Give exp. and refs. "Eastern Ohio." AM. MACH.

Competent draftsman, familiar with shop work, wishes position. Address Box 86, AM. MACHINIST.

Wanted—Position as engineer; have had charge of a steam plant for several years; thoroughly competent. Best refs. Box 40, AMERICAN MACHINIST.

Wanted—A thorough prac. brass finisher, competent to take charge of finishing dep't. Will make a liberal offer to right man. Essex & Co., London, Ont.

Wanted—Competent draftsman accustomed to locomotive work. State experience and salary, and give references. Locomotive, Box 727, N. Y. city.

Wanted—Position by an experienced die sinker for drop forgings. Brooklyn or N. Y. City preferred. Address S. E., care AMERICAN MACHINIST.

Wanted—Two or three good lathe hands, one man for heavy boring mill; all on piece-work. Liberal pay to good men. Address "Ohio," AMERICAN MACHINIST.

Wanted—A foreman to take charge of the tool and repair shop of a works forging and finishing goods in iron and steel. Address, stating age and experience, A. Y., AMERICAN MACHINIST.

Machinists Wanted—Vise hands accustomed to first-class work. Steady employm't and liberal wages guaranteed. Have largely increased our plant and need more men. Niles Tool Works, Hamilton, O.

Expert mech. and draftsman, holding position as ass't sup't, is open to engagement. Line: lighter machinery and tools, also arrangement of equipment in factories. Address "Shop Practice," AM. MACH.

Wanted—Practical foreman to sup'd dep't in the erecting of small tools, lathes, drill presses, turret lathes, milling machines, etc.; must be competent in handling men. Address with ref's, A. B., AM. MACH.

Wanted—An active, intelligent foreman for machine shop in Western New York; must be able to handle men to advantage. Good position for man of ability. Address, stating age, terms and experience, Box 33, AMERICAN MACHINIST.

Wanted—A practical machinist who understands engine building, with steady habits, with from $2,000 to $3,000, to take a part interest in the manufacturing of engines and small goods. Address O. L. G., AMERICAN MACHINIST.

Wanted—Foundry foreman. A first-class, active manager of men, in an Ohio foundry making light and medium castings. Address at once, with references, and stating salary expected, "Piecework," care AMERICAN MACHINIST.

Young machinist, on fine vise work, some exp. in die and tool making, can run lathe and shaper to small amount, wants position in first-class die or tool shop, or some fine mech'l work. Wants to learn. G. P. K., 239 E. Illinois st., 1st flat, Chicago, Ill.

A practical mechanical engineer, now in charge of a well-known manufacturing business employing between 400 and 500 hands, is desirous of making a change. Experienced in factory designing and building, economical arrangement of plants, and modern economical methods of handling help and labor-saving devices, also in arrangement of steam plants, steam engine, indicating and boiler tests. Address "X & Y," care AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

20" Lever Drill Presses, $65. S. M. York, Clevel'd, O.

Koopman's Scales for quick measurements.

Glass Triangles. F. E. Harthan, Worcester, Mass.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, O.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, O.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

August C. Christensen, 24 State st., N. Y., Consulting Engineer. Designs of all kinds of Machinery.

Turned and Highly Polished Iron and Steel Shafting a specialty. Merwin McKaig, Cumberland, Md.

Complete list of our Scales and other new tools for 2c. stamp. A. T. Koopman, Chicago.

D. J. Kelsey, M. E., Designer of Automatic Machinery, 31 Insurance Building, New Haven, Conn.

Wanted—Two engine lathes, about 16 inch swing. One upright drill, about 20 inch. Second-hand. J. W. M. Barton, Vt.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Wanted—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

Established 1832. BRADLEY'S POWER HAMMERS

The BEST in the WORLD

RUN BY BELT.

BRADLEY'S HELVE HAMMER.

Over 1500 in USE

BRADLEY'S UPRIGHT HAMMER.

BRADLEY'S UPRIGHT HAMMER.

BRADLEY'S HEATING FORGES

BRADLEY'S HARD COAL HEATING FORGE.

Indispensable in all shops to keep BRADLEY'S CUSHIONED HAMMERS and men fully employed and reduce the cost of production.

BRADLEY'S SOFT COAL FORGE.

BRADLEY & CO. SYRACUSE, N.Y.
13 Murray st. NEW YORK; 98 Sudbury st. BOSTON, MASS

A TREATISE ON STEAM BOILERS.

Their Strength, Construction and Economical Working. By Robert Wilson, C. E. Enlarged from the 5th English edition by J. J. Flather, Ph. D., with the addition of numerous fine illustrations. 12mo, cloth $2.50

JOHN WILEY & SONS, NEW YORK

Prepaid by Mail on the receipt of the price.

TOOL AGENTS WANTED In every Shop in the United States. Send 10c. for Catalogue, Stationery &c.
THE FINEST OF MECHANICAL TOOLS A SPECIALTY.
C. B. JAMES, 98 Lake St., Chicago, Ill.

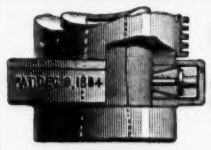
WILLIAM JESSOP & SONS, L'D.

MANUFACTORY, SHEFFIELD, ENGLAND. | Chief American Office, 91 JOHN ST., NEW YORK.

JESSOP'S BEST TOOL STEEL

Gold Medal, Paris, 1889.

ALL KINDS OF Steel in Stock. Importation Orders Promptly filled.



THE BROWNELL ANTI-FRICTION Step or Thrust Bearing FOR Lathes, Drills, Worm Shafts of Elevators or Hoists, Jack Screws, Mill Stones, Water Wheel and Propeller Shafts.

Bearings of all sizes made to order, and patent rights for sale by

G. L. BROWNELL, WORCESTER, MASS.

Correspondence Solicited.

TO BUYERS AND USERS OF MACHINERY.

You will save money and get what you pay for by having us examine machinery and report on the same before buying. Try us and be convinced.

We also make drawings and blue prints, and give SPECIAL ATTENTION TO THE DESIGNING OF MACHINERY FOR ALL PURPOSES. Send for Blue Book giving more information.

JONES & MACK, MECHANICAL ENGINEERS,

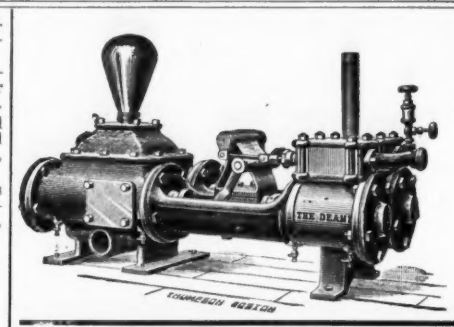
5 W. 4th Street, Cincinnati, O.

COMPLETE STEAM PUMP ONLY SEVEN DOLLARS

DEMAND THIS PUMP OF YOUR DEALER. OR WRITE TO US FOR PRICES.

VAN DUZEN'S PATENT

VAN DUZEN & TIFT. SOLE MAKERS CINCINNATI, O.



THE DEANE STEAM PUMP CO.,

HOLYOKE, MASS.,

New York, Boston, Chicago, Philadelphia, St. Louis,

Manufacturers of

STEAM and POWER PUMPS

FOR ALL PURPOSES.

SEND FOR CATALOGUE.

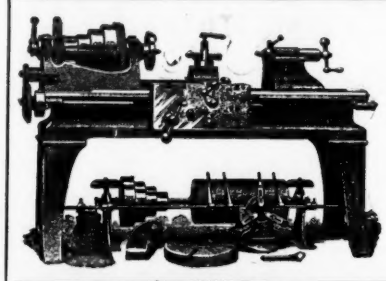
"CRESCENT EXTRA"

Is now used by many of the largest and most carefully managed shops for all **Lathe and Planer Tools, Punches, Dies, Taps, Reamers, &c.**

This steel is famous for its uniformity and great endurance, and should be specified by Machinists and Tool-makers who want the best stock for their tools.

CRESCENT STEEL WORKS,

CHICAGO, ILLS. PITTSBURGH, PA. NEW YORK, N. Y



SEBASTIAN, MAY & CO.'S

—NEW—

18-in. Engine Lathe.

Just introduced. New design. All the latest improvements. Write for cuts and prices. Complete catalogue of foot and power lathes and tools mailed on application.

167 W. 2nd Street, Cincinnati, Ohio.

TOBIN BRONZE

Tensile Strength upwards of 79,000 lbs. per sq. in.
Torsional Strength equal to the best Machinery Steel.
Anti-Frictional and Non-Corrosive.

CAN BE FORCED HOT.

Rods for pumps and bolts. Yacht shafting. Rolled sheets and plates for pump linings and condenser tube sheets, &c. Ingot metal for car and engine bearings. Spring wire.

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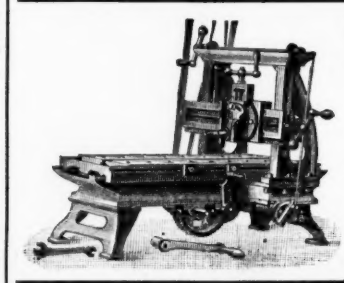

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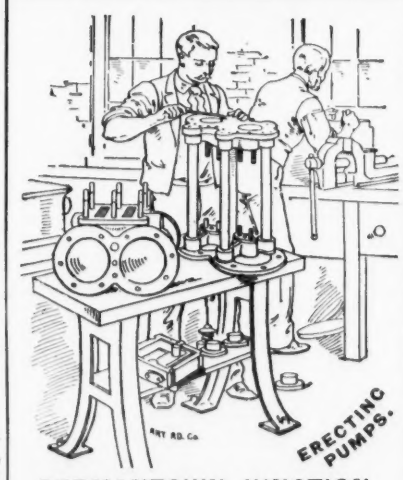

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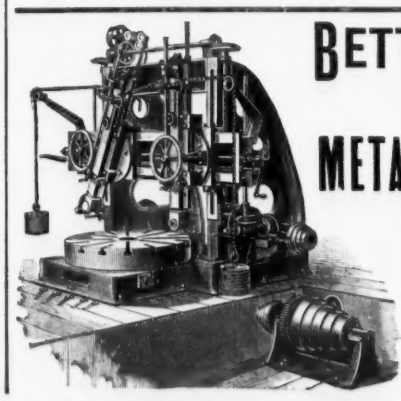

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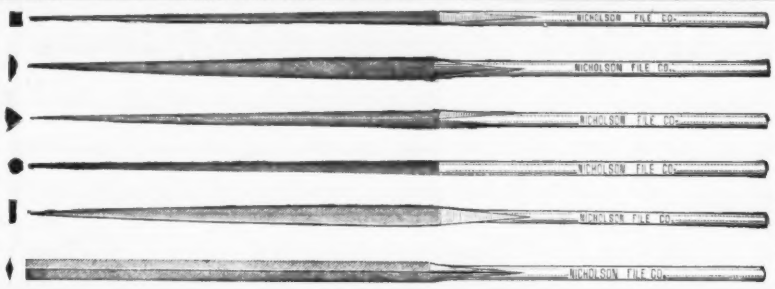

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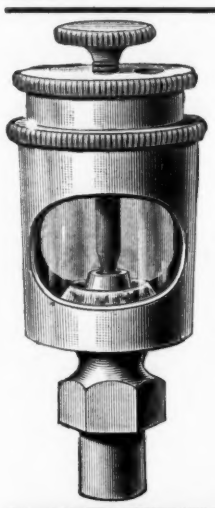

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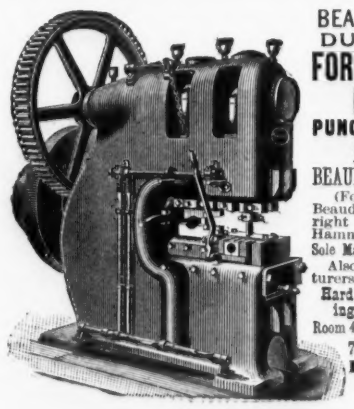

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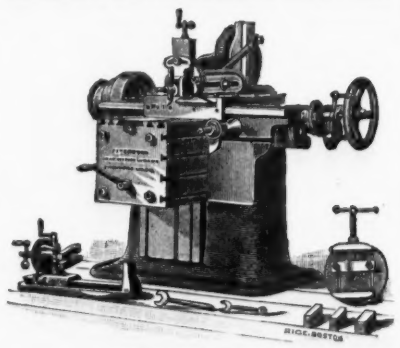

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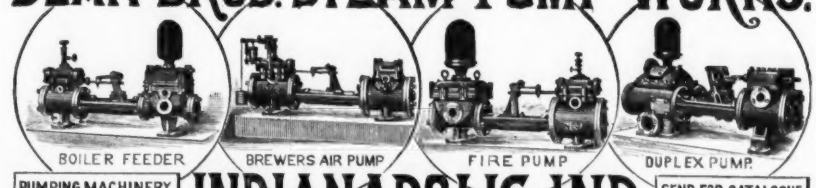

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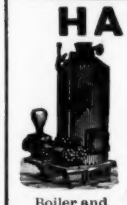
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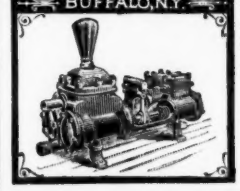

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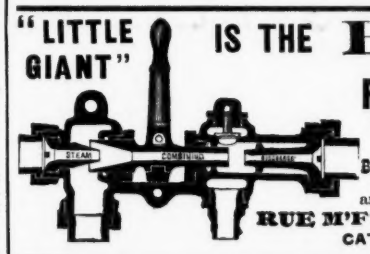

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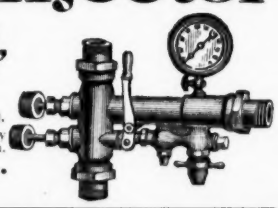

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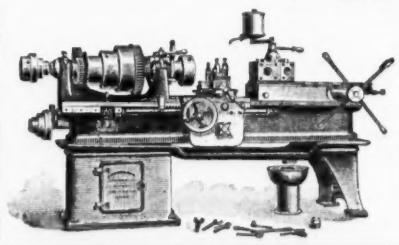

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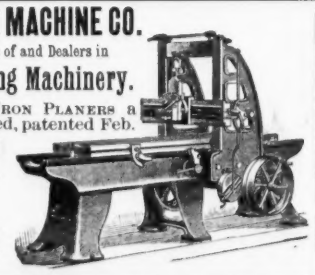

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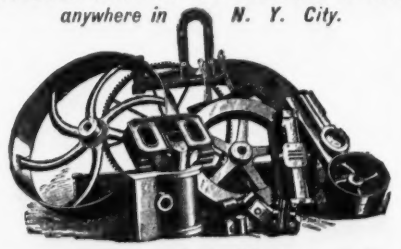

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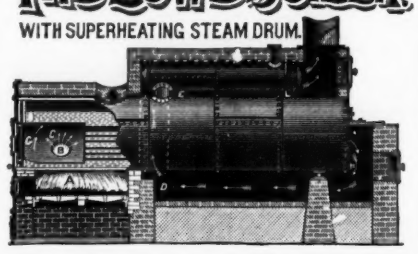

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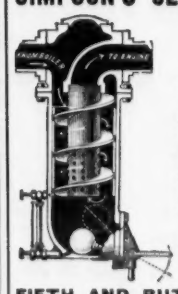

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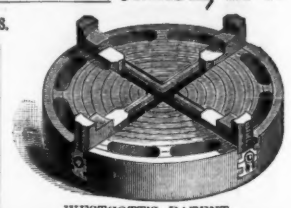

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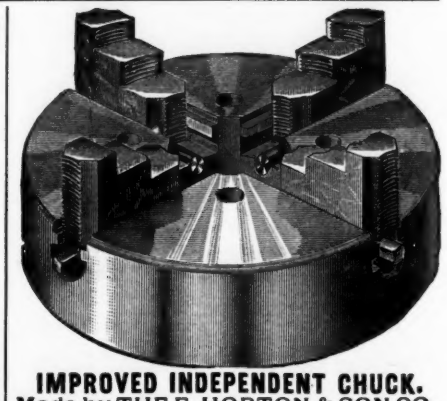

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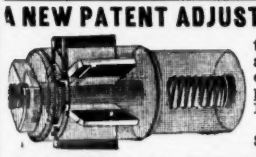

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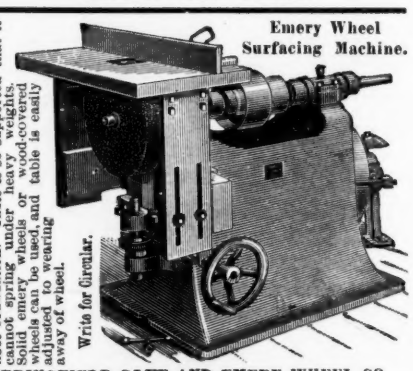

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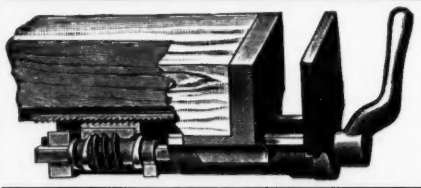

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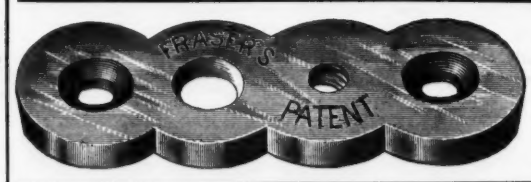

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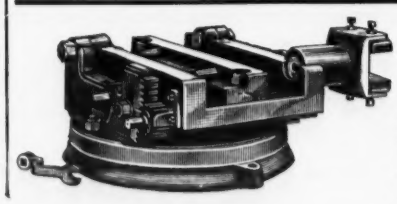

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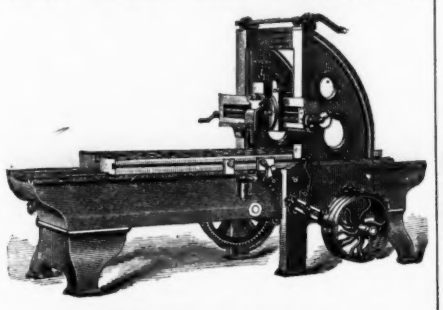

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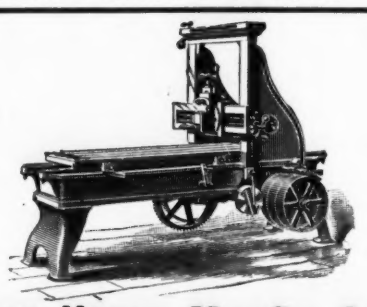

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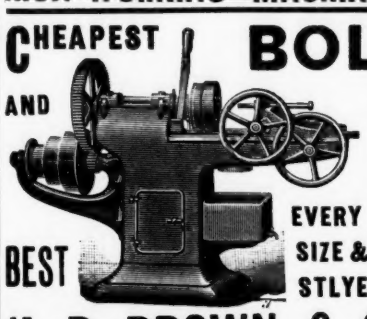

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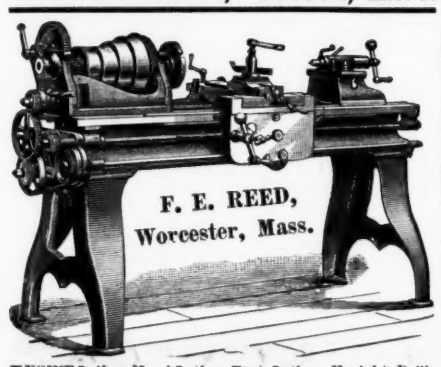

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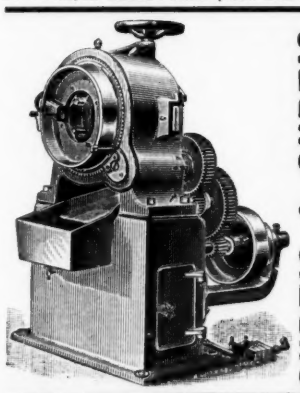

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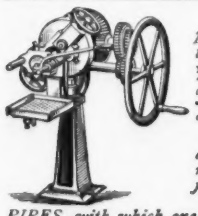

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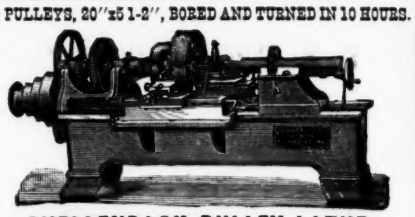

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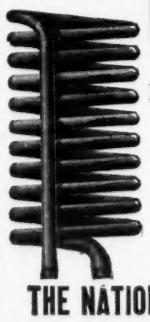

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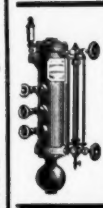

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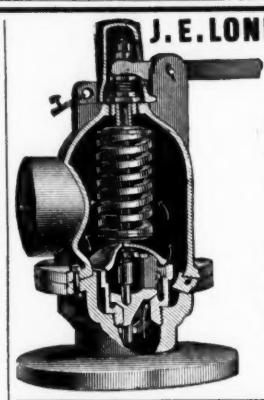

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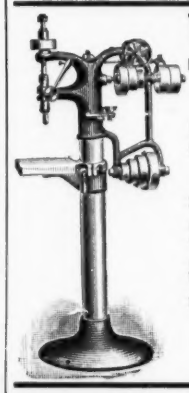

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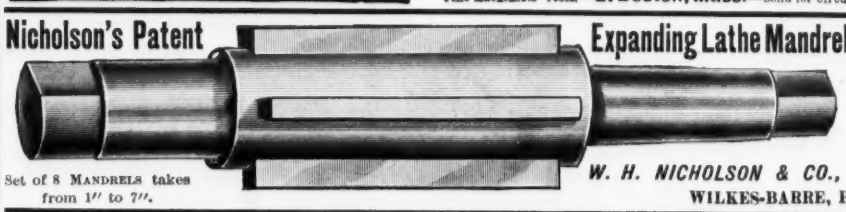

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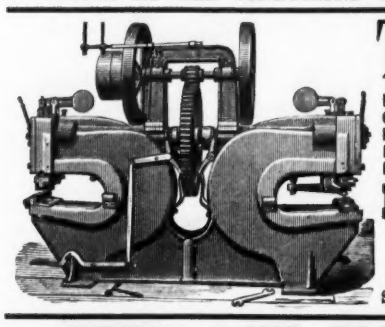

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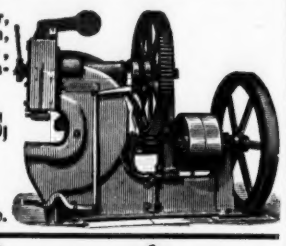

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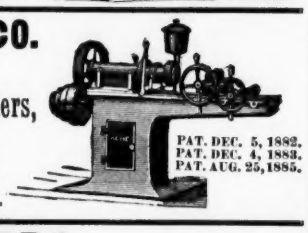

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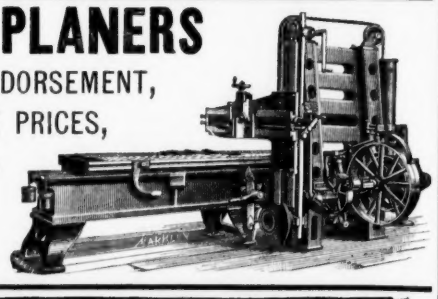

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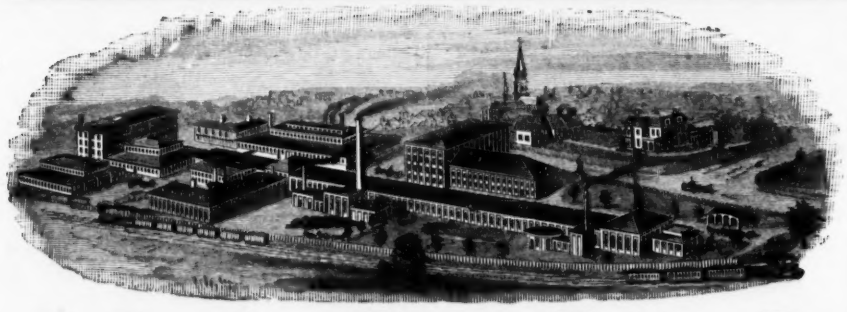

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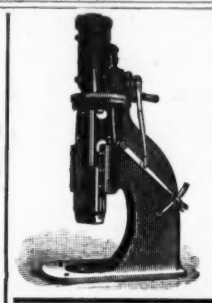

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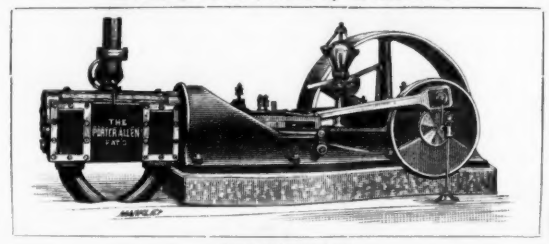

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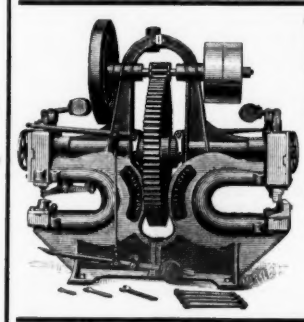

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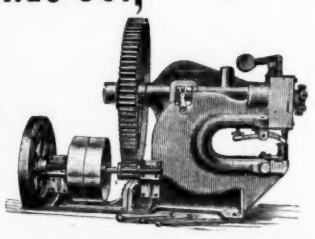

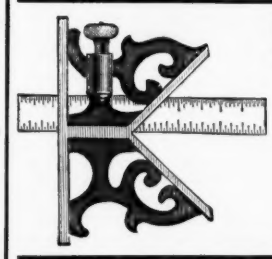

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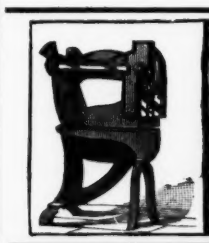

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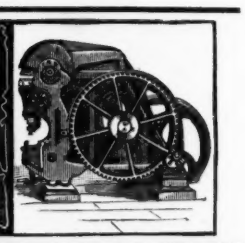

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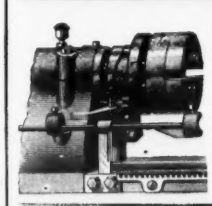

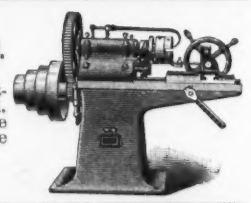

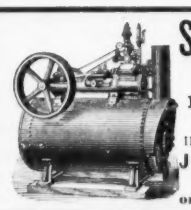

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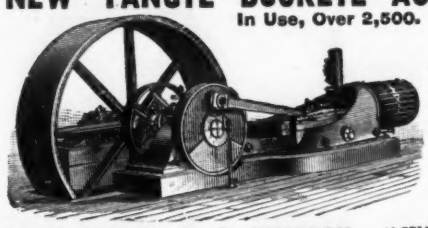

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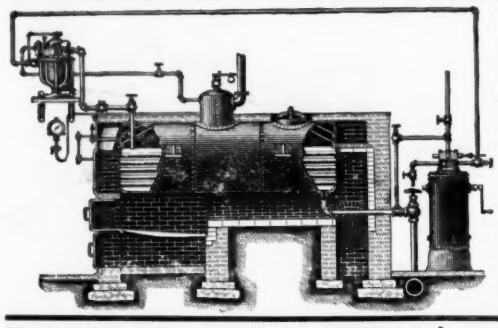

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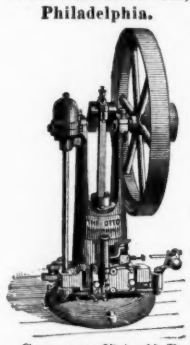

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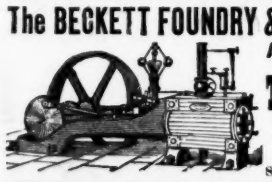

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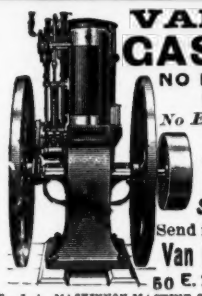

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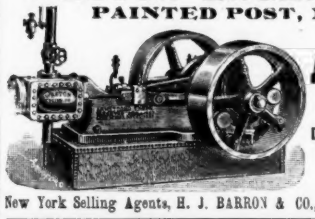

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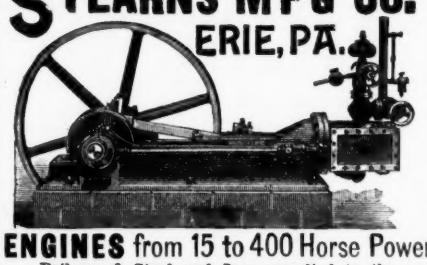

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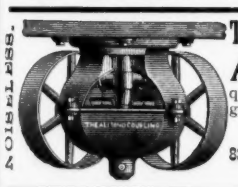

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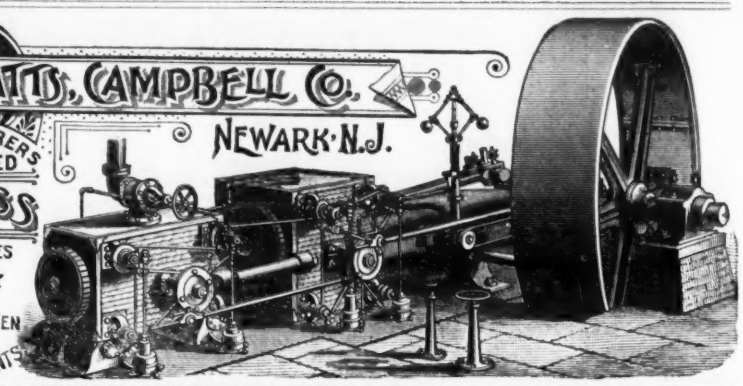

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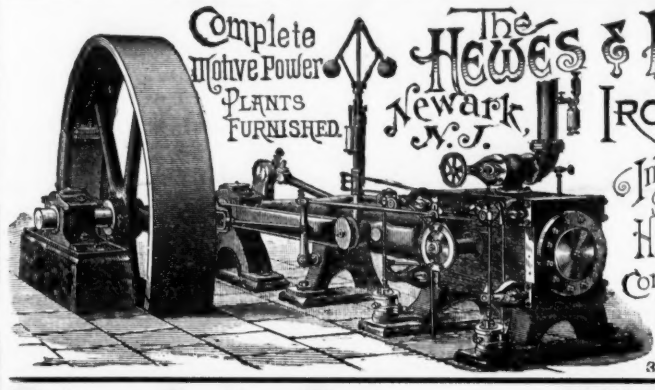

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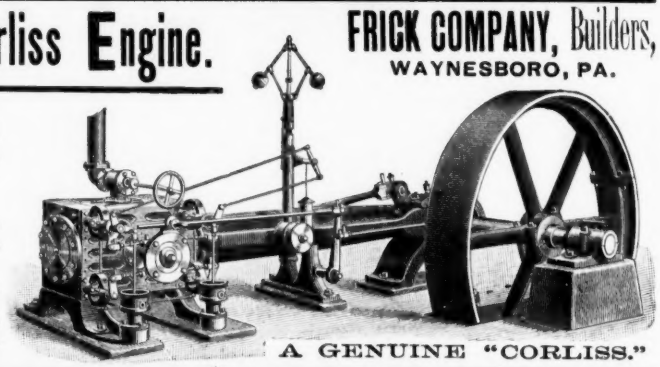

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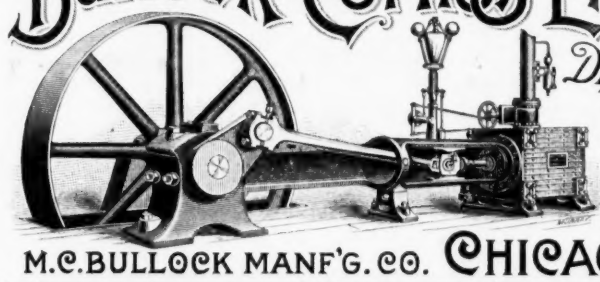

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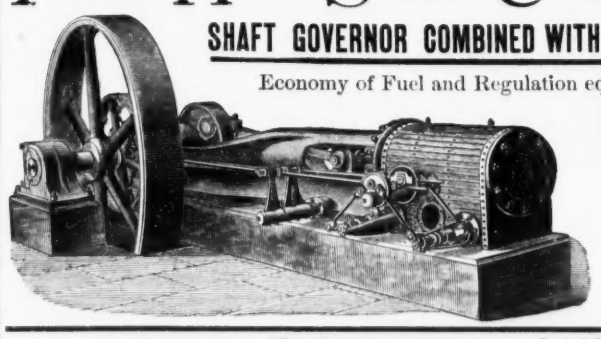

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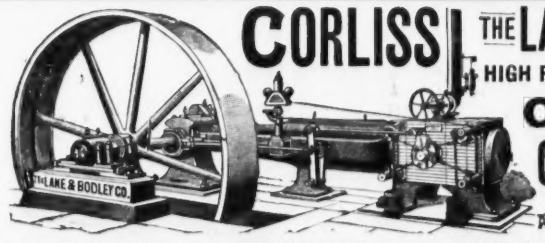

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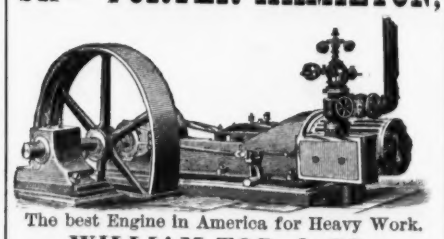

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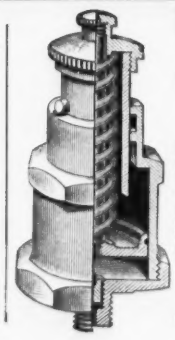

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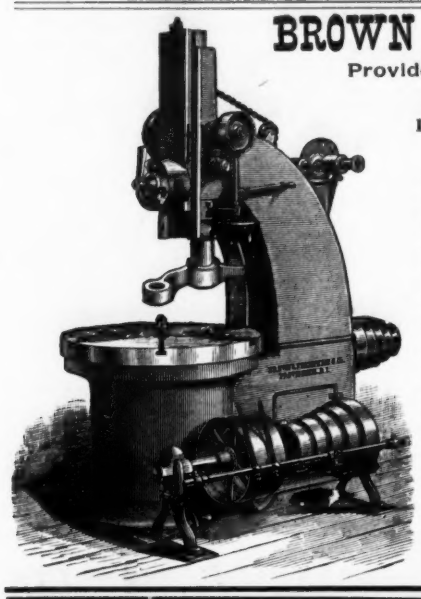

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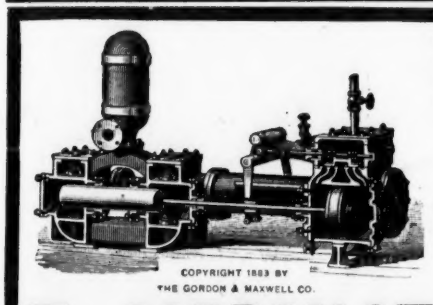

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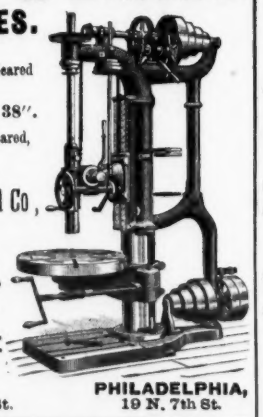

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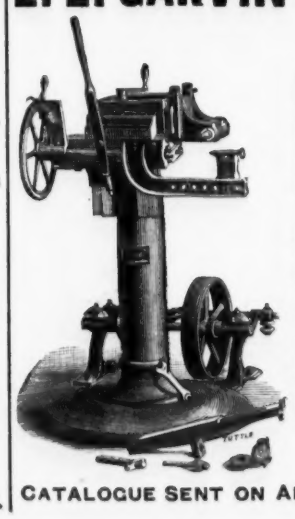

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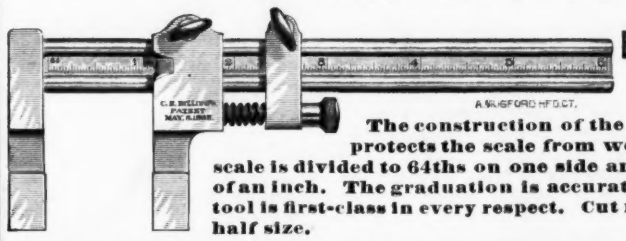

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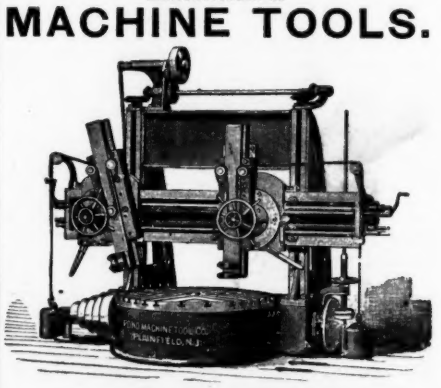

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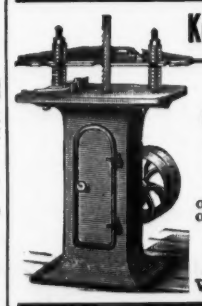

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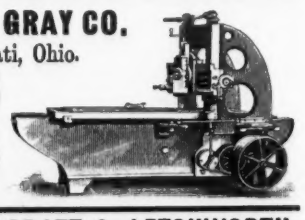

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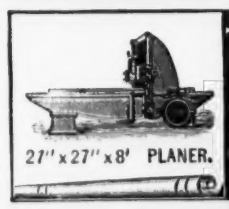

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